Installation Instructions

Allen-Bradley

PowerFlex 700 Drive - Frame 9 Components Replacement

Catalog Numbers 20B

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

	SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

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This manual contains new and updated information.

New and Updated Information

This table contains the changes made to this revision.

Topic	Page
Updated the Component Kits table with the new balancing resistor kit catalog numbers.	9
Updated Figure 3 - Frame 9 Busbars (AC Drive shown) to include the new balancing resistor bus bar assembly.	16
Updated the Balancing Resistor and DC+ Bus Bar instructions for removing and installing the new kit.	53
Moved the summary of changes information for the previous revision to Appendix A - History of Changes.	91

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History of Changes

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Introduction

This publication provides guidelines for replacing the major components in the PowerFlex 700 Frame 9 drive.

Component Kits

All kits include the necessary components, ESD wrist strap and hardware (if required), and thermal grease (if required). Do not reuse any hardware unless directed to do so.

Description	Kit Catalog No.	Notes
Printed Circuit Boards		
Gate Interface Board	SK-G1-GDB1-F8910	Drive requires three kits
Precharge Board	SK-G9-PRE1-V480	AC input
	1336-PB-SP22C	DC input
Power Interface Board	SK-G9-GDB1-D700	730 A
Main Control Board	SK-G9-VMCB1-D0	115V I/O
	SK-G9-VMCB1-C0	24V I/O
T-Comm Board	SK-G9-TCOMM	
Switch Mode Power Supply Board	SK-G9-PWRS1-D0	
24V Power Supply Board (CTS)	SK-G9-PSR24	
DC Bus Filter Board	2364-SPP02A	
Fans and Main Fan Circuit Components		
Heatsink Fan	SK-G1-FAN1-F9	Includes Fan and Fan enclosure
Capacitor Fan	SK-G1-FAN2-F8910	
Power Module Sub-assemblies		
Inverter Power Module (IGBT)	SK-G1-QOUT1-F910	Includes: • One IGBT module • One Gate Interface Board • Gate Interconnect Harness • Six Flexible Capacitor Busbars • Three Snubber Capacitors • One Tie Down Capacitor Mount Drive requires three kits.
Converter Power Module (SCR)	SK-G1-SCR1-F89	For AC input drives only. Kit includes three SCR Modules.
SCR Snubber Kit	SK-G1-SCRSNUBRB	AC input drive requires three kits. DC input drive requires one kit.
DC Precharge SCR Module	SK-G1-SCR2-F89	For DC input drives only. Includes: • One SCR Module • One Diode
DC Link Choke	SK-G1-DCCHOKE1-F9	For AC input drives only
Miscellaneous		
Current Transducer	SK-G1-CT1-F910	Includes one Transducer. Drive requires three kits.
Thermal Sensor Kit	SK-G1-THM1-F89	For AC input drives only. Includes: • Main Control Panel Thermal Sensor • Heatsink Thermal Sensor
	SK-G1-THM2-F89	For DC input drives only. Includes: • Main Control Panel Thermal Sensor • Heatsink Thermal Sensor
Bus Capacitor Kit	SK-G1-BUSCAP1-F9	Includes one Capacitor. Drive requires 18 kits.
Miscellaneous (continued)		

Description	Kit Catalog No.	Notes
Capacitor Bus Finger Kit	SK-G1-FLXBUS1	Included with the kit for Inverter Power Module (IGBT). Can be ordered separately. Includes: • Three positive Flexible Capacitor Busbars • Three negative Flexible Capacitor Busbars
MOV Surge Suppressor	SK-G1-MOV1-F89	For AC input drives only.
Power Supply, 24V	SK-G9-PWRS24	
Transformer, 500 VA	SK-G9-XFMR1-F89	For AC input drives only. Includes: • One Transformer • Three fuses
Transformer Fuses	SK-G9-FUSE1-F8	For AC input drives only. Includes three fuses.
Balancing Resistor Kit	SK-G1-RB1-F910 (Replaces 1336-RLOAD-SP3A) (1)	AC Input (includes DC+ bus bar and resistor assembly).
	SK-G1-CBRB1-F910 (Replaces 1336-RLOAD-SP3A) (1)	DC Input (includes DC+ bus bar and resistor assembly).

(1) This kits was issued to correct a potential anomaly for frame 9 PowerFlex 700 AC drives. See Product Safety Advisory #2014-06-002 for more information.

See the master parts list for the most up-to-date information:

http://www.ab.com/support/abdrives/powerflex70/PF7ReleasedParts.pdf

IMPORTANT See the instruction sheet included with each component kit for discarding or returning replaced components. If discarding, be sure to discard according to local, state, and federal regulations.

Recommended Tools

The following list of tools is provided for your reference to disassemble and assemble the drive and components. This list may not be all-encompassing for your situation. Not all tools are needed for some components. See pertinent sections for details.

Description
Torque wrench (metered in N•m or lb•in)
Volt ohm meter
Torque seal or colored marker
Screwdrivers (standard, Phillips, torx — various sizes)
Magnetic screwdriver, long
Socket set, metric
Cylindrical pick-up magnet
Pliers, regular and needle-nose
Wire cutters
Isopropyl alcohol and applicator cloth
Nylon tie wraps
3- or 4-inch paint roller with short nap or 3- or 4-inch putty knife (for installing SCR modules)
Pencil

Safety Precautions

The precautions and general installation requirements provided in the PowerFlex 700 Frame 7-10 Installation Instructions (publication 20B-IN014) and the PowerFlex 700 User Manual (publication 20B-UM002) must be followed with those included here.

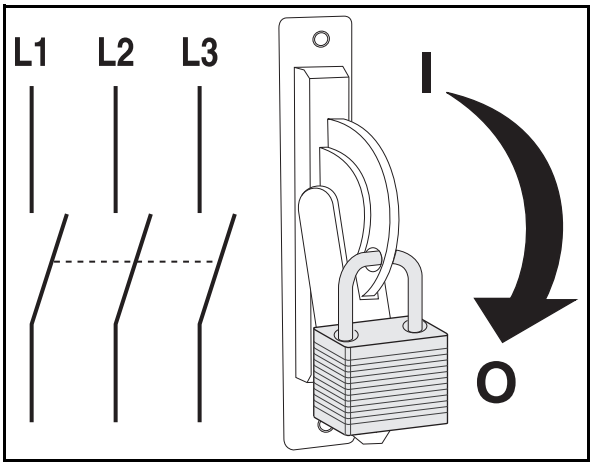
ATTENTION: To avoid an electric shock hazard, ensure that all power has been removed before proceeding. In addition, before servicing, verify that the voltage on the bus capacitors has discharged. Check the DC bus voltage at the Power Terminals by measuring between the +DC & -DC terminals, between the +DC terminal and the chassis, and between the -DC terminal and the chassis. The voltage must be zero for all three measurements.

Remove power before making or breaking cable connections. When you remove or insert a cable connector with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system's field devices, causing unintended machine motion.
- causing an explosion in a hazardous environment.

Electrical arcing causes excessive wear to contacts on the module and its mating connector. Worn contacts may create electrical resistance.

1. Turn off and lock out input power. Wait five minutes.
2. Verify that there is no voltage at the drive's input power terminals.
3. Check the DC bus voltage at the Power Terminals by measuring between the +DC and –DC terminals, between the +DC terminal and the chassis, and between the –DC terminal and the chassis. The voltage must be zero for all three measurements.



ATTENTION: This assembly contains parts and sub-assemblies that are sensitive to electrostatic discharge. Static control precautions are required when servicing this assembly. Component damage may result if you ignore electrostatic discharge control procedures. If you are not familiar with static control procedures, refer to Guarding Against Electrostatic Damage, Allen-Bradley publication 8000-4.5.2, or any other applicable ESD protection handbook.

The information in this publication is merely a guide for proper installation. Rockwell Automation, Inc. cannot assume responsibility for the compliance or the noncompliance to any code (national, local, or otherwise) for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored.

Only qualified personnel familiar with adjustable frequency AC drives and associated machinery should plan or implement the installation, start-up, and subsequent maintenance of the system. Failure to comply may result in personal injury and/or equipment damage.

HOT surfaces can cause severe burns. **Do not** touch the heatsink surface during operation of the drive. After disconnecting power, allow time for cooling.

Replace all protective shields before applying power to the drive. Failure to replace protective shields may result in death or serious injury.

Important Initial Steps

Read and follow these statements before performing any service on the drive.

- Read and follow the precautions in Safety Precautions on page 11.
- Identify components to be replaced using Component Diagrams and Torque Specifications on page 13.
- Remove protective shields only as necessary.
- Before disconnecting any wire or cable, verify that it is labeled. Also, when removing components, note hardware type and location.
- When torquing any fasteners, use a colored marker or torque seal to mark each screw after torquing so you know when all are done and to indicate signs of any subsequent tampering.
- See the product installation documentation for startup and other instructions after servicing.

Component Diagrams and Torque Specifications

Overview

Drive components and their locations are identified in this chapter, as well as torque specifications for fasteners that are part of component removal and replacement.

Figure 1 - Frame 9 - AC Drive Components

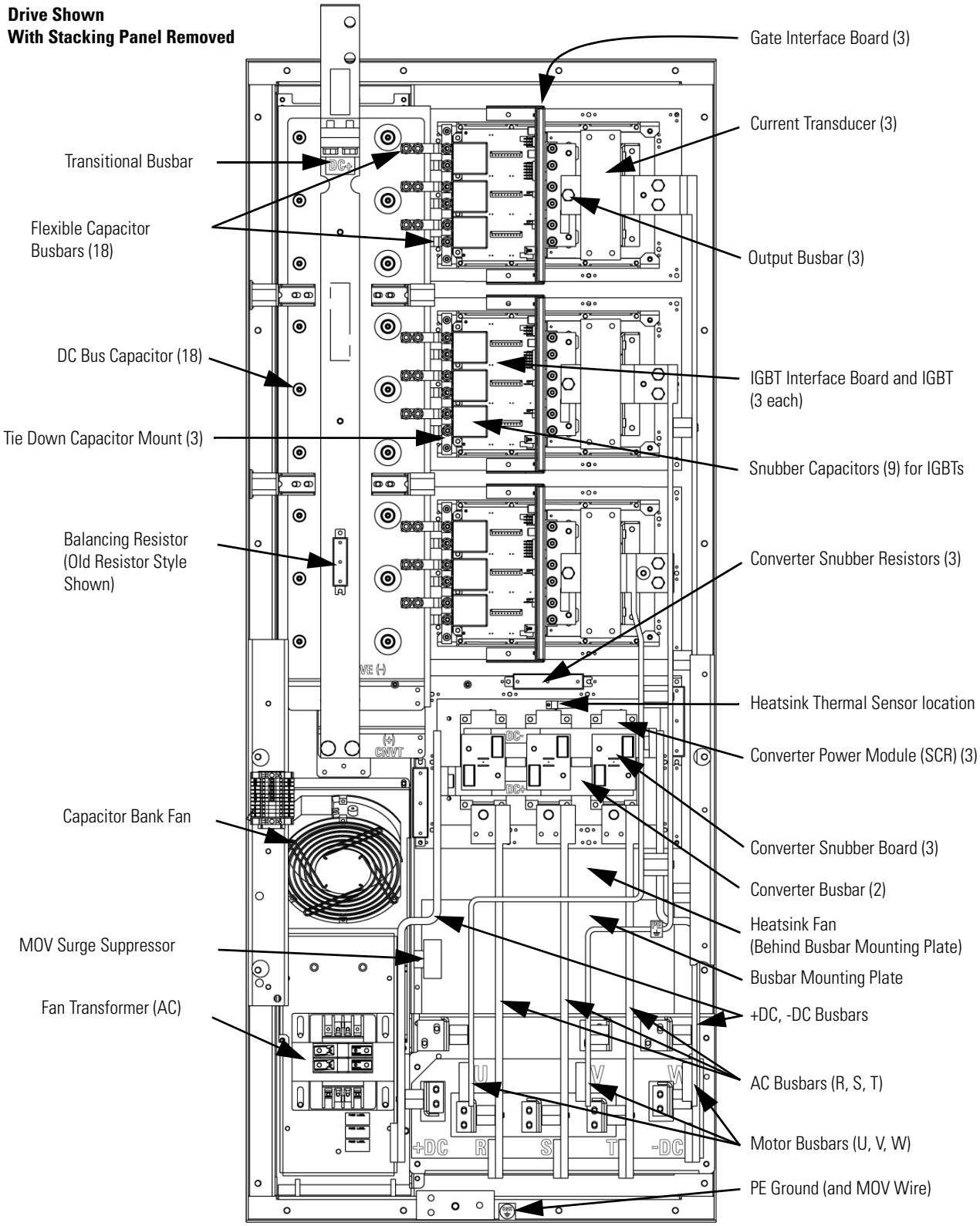


Figure 2 - Frame 9 - DC Drive Components

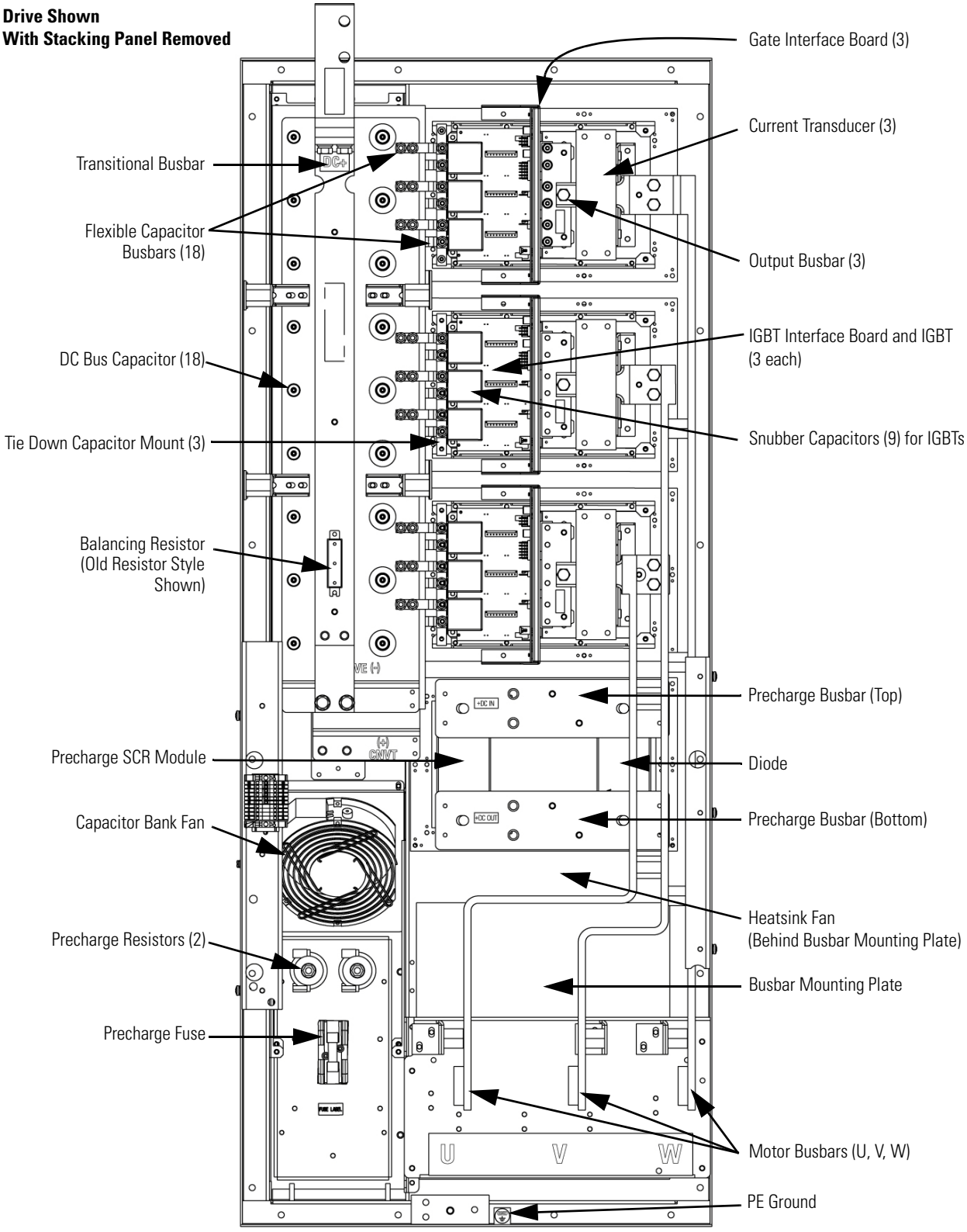


Figure 3 - Frame 9 Busbars (AC Drive shown)

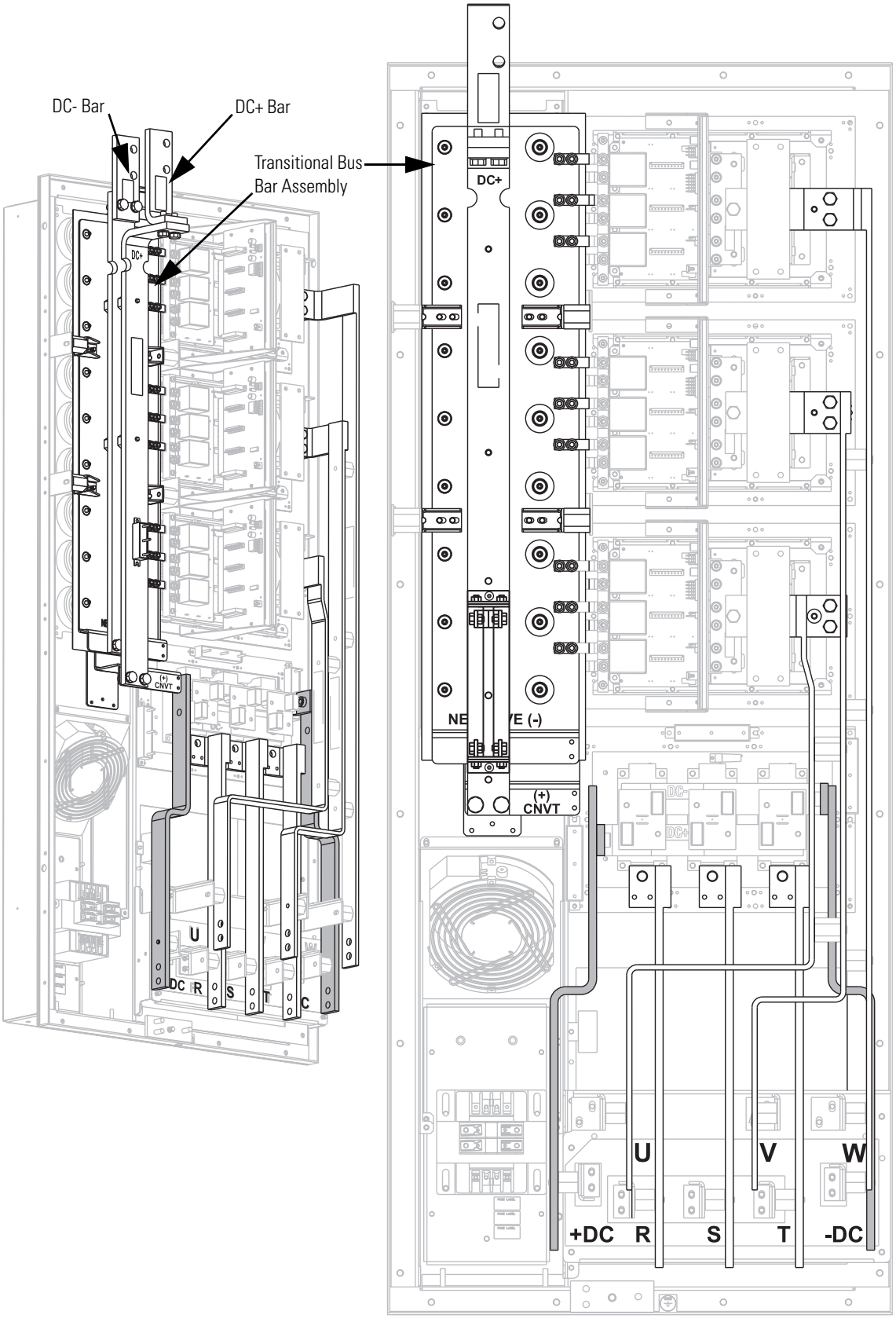
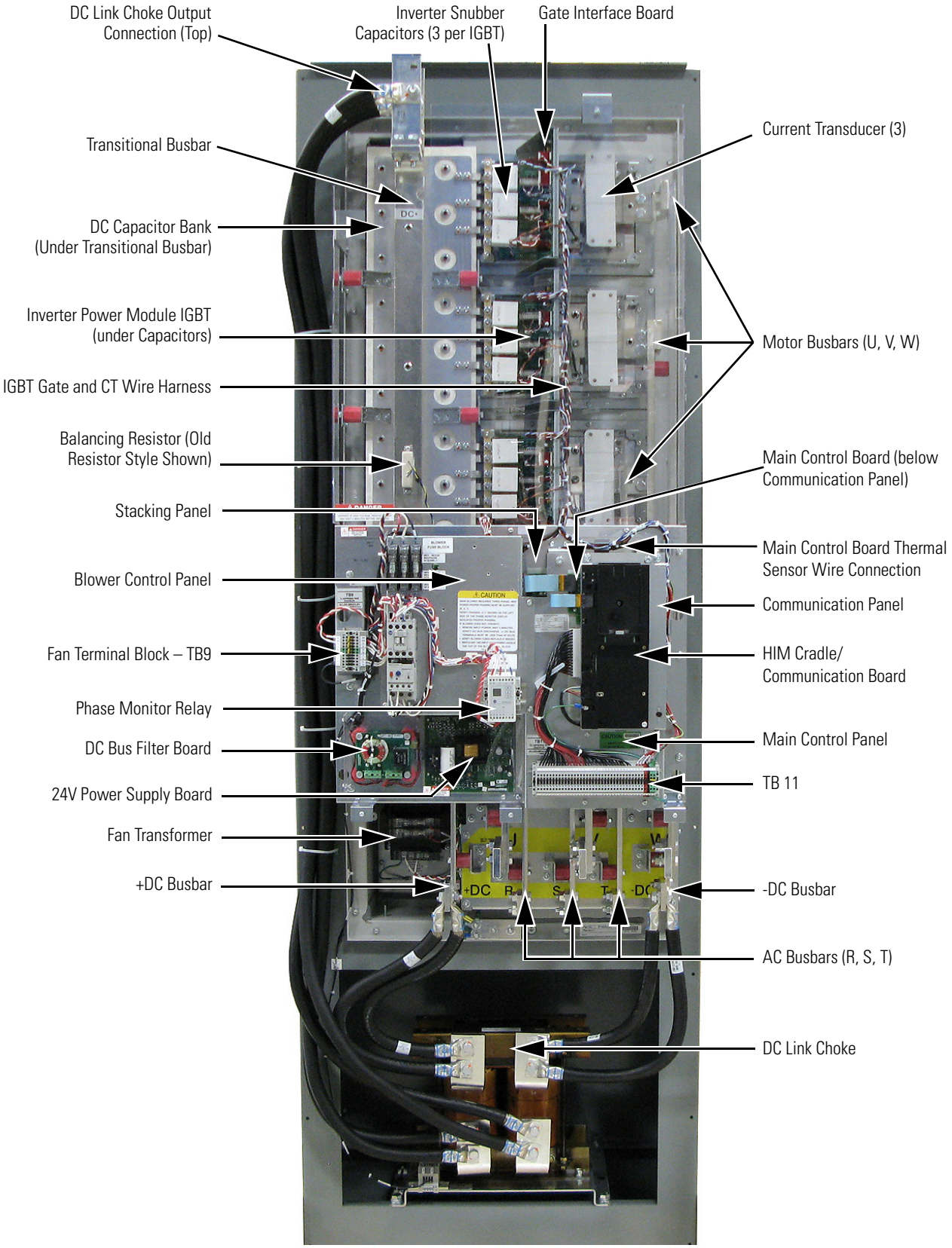
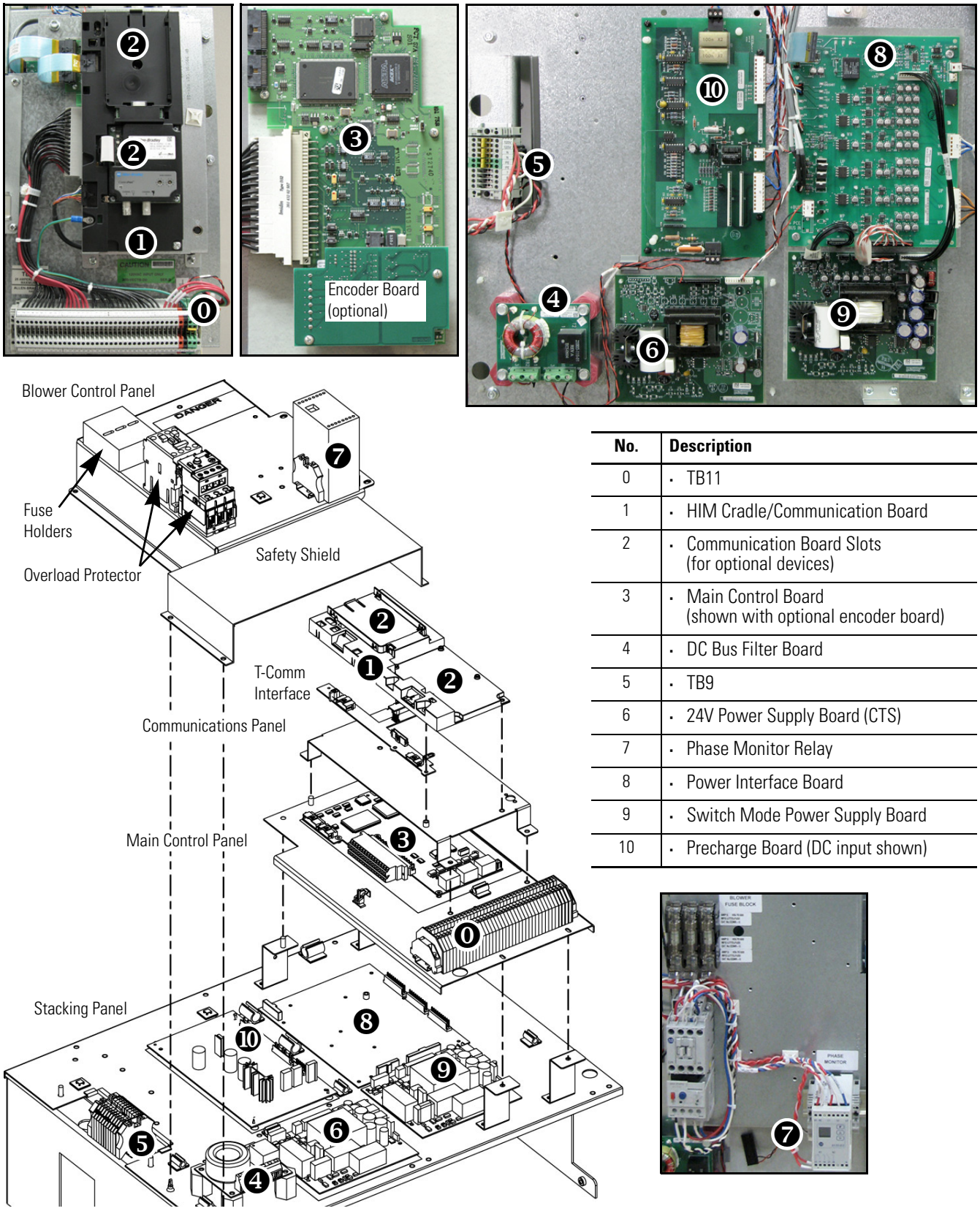


Figure 4 - Frame 9 (AC input drive shown)



Circuit Boards

Figure 5 - Circuit Boards on Frame 9



No.	Description
0	• TB11
1	• HIM Cradle/Communication Board
2	• Communication Board Slots (for optional devices)
3	• Main Control Board (shown with optional encoder board)
4	• DC Bus Filter Board
5	• TB9
6	• 24V Power Supply Board (CTS)
7	• Phase Monitor Relay
8	• Power Interface Board
9	• Switch Mode Power Supply Board
10	• Precharge Board (DC input shown)

Fastener Torque Specifications

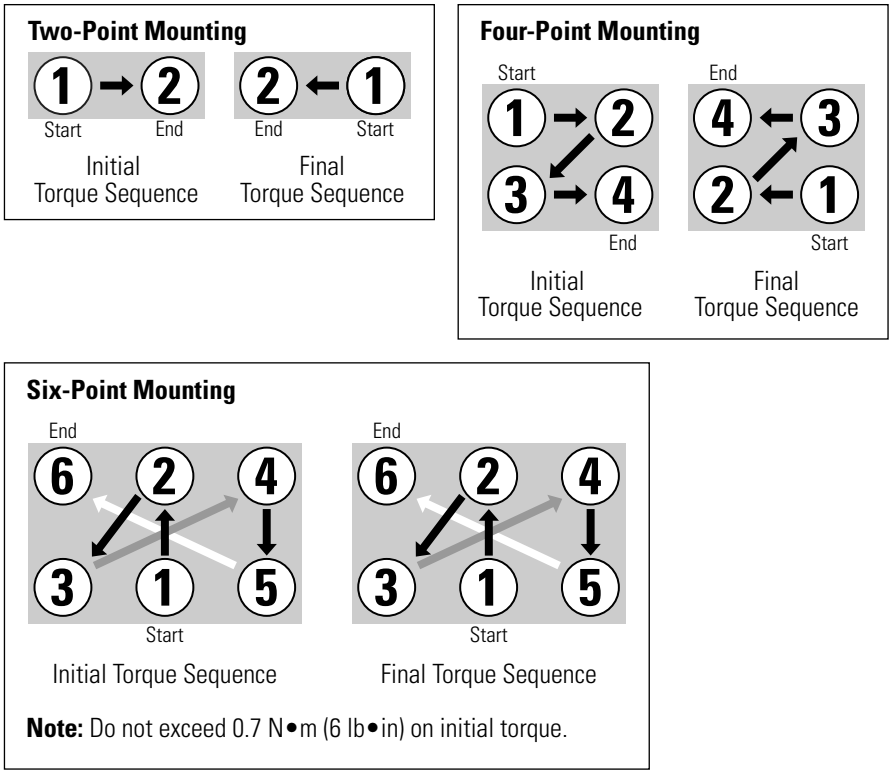
Torque Sequence

ATTENTION: When mounting components to a drive's heat sink, component fastener torque sequences and tolerances are crucial to component-to-heat sink heat dissipation.

Components can be damaged if initial tightening procedure is not performed to specification.

Figure 6 illustrates initial and final tightening sequences for components fastened to a heat sink using two, four, and six screws. Initial torque is one-third (33.3%) of final torque, except six-point mountings, which require 0.7 N•m (6 lb•in.) The numeric illustration labels are for your assistance. Drive components do not carry these labels.

Figure 6 - Various-Point Mounting



Note: Do not exceed 0.7 N•m (6 lb•in) on initial torque.

Torque Specifications

The following table lists fastener locations by component, how the fasteners are used, and torque specifications. See Torque Sequence on page 19 in this chapter for fastening two-point, four-point, and six-point components to the heat sink.

Component	Fastener Application	Torque	
		lb•in	N•m
Fan Motor	Motor to Fan Cover Assembly	14	2
Fan Cover Assembly	Assembly to chassis	26	3
Fan Transformer	Transformer to chassis	26	3
Fan Capacitor	Capacitor to chassis	Hand tighten	
MOV Surge Suppressor	MOV to chassis	14	2
Converter Snubber Board	Board to Input Rectifier	50	6
Balancing Resistor	Resistor to heat sink Initial sequence:	6	0.7
	Final sequence:	26	3
Balancing Resistor	Wires to Capacitor Busbar Assembly	50	6
Converter Heatsink Thermal Sensor	Thermistor to heatsink	14	2
Main Control Panel Thermal Sensor	Thermistor to mounting bracket	14	2
Bus Capacitor Holder	Holder to Bus Capacitors	26	3
Capacitor Busbar Assembly	Assembly to Bus Capacitors	50	6
Gate Interface Board	Board to Power Modules	14	2
Inverter Power Module (IGBT) Busbar	Busbar to Power Modules	80	9
Inverter Power Module (IGBT)	Module to heat sink Initial sequence:	6	0.7
	Final sequence:	32	3.6
DIN Rail (TB1)	Rail to chassis	50	6
PE Shortening Bar	Bar to TB1	80	9
Converter Power Module (SCR)	SCR to heat sink Initial sequence:	6	0.7
	Final sequence:	50	6
Transitional Busbar Assembly	Assembly to Power Module Busbar Assembly	80	9
DC Bus Inductor L1	Inductor to chassis	50	6
Busbar Cable Adaptor	Adaptor to Transitional Busbar and DC Bus Inductor	80	9
Converter Bus and Motor Busbars	Busbars to all connections	80	9
Wires (PE)	Wires to Ground Stud	80	9
Wires	Wires to TB1	80	9
Wire (TE)	Wire to TB1	50	6
Wires	Wires to TB2	7	0.8

Component	Fastener Application	Torque	
		lb•in	N•m
Wires	Wires to TB3	8 – 10	0.9 – 1.1
CT Mounting Plate	Mounting Plate to CT Clamping Plate	14	2
CT Clamping Plate	Clamping Plate to Busbar	26	3
Power Cables	Cables to terminals	80	9
Main Control, Gate Driver, Precharge Board Mounting Plates	Plates to chassis	26	3
High Voltage Guard	Guard to chassis	26	3

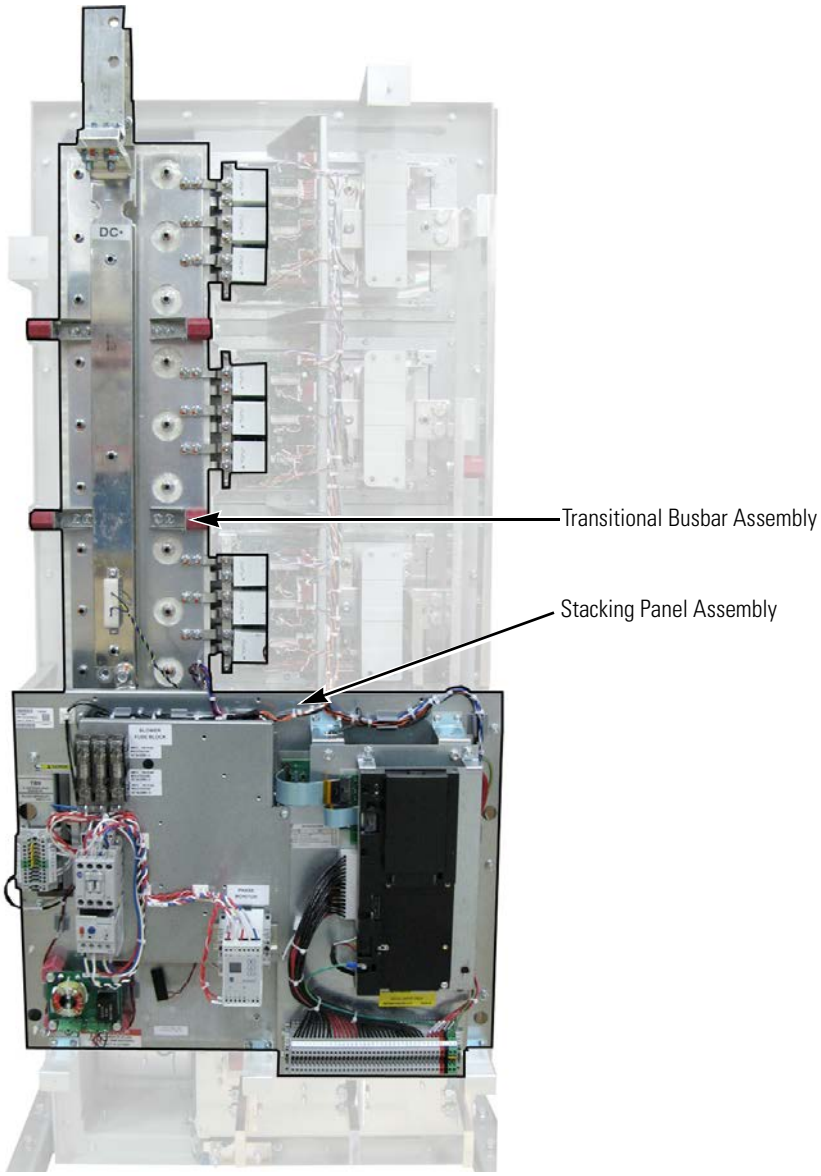
Notes:

Basic Component Removal Procedures

Overview

Component removal procedures detailed in this chapter are located on the Stacking Panel and Transitional Busbar assemblies highlighted below.

See Circuit Boards on page 18 to identify the various panels that comprise the Stacking Panel assembly.

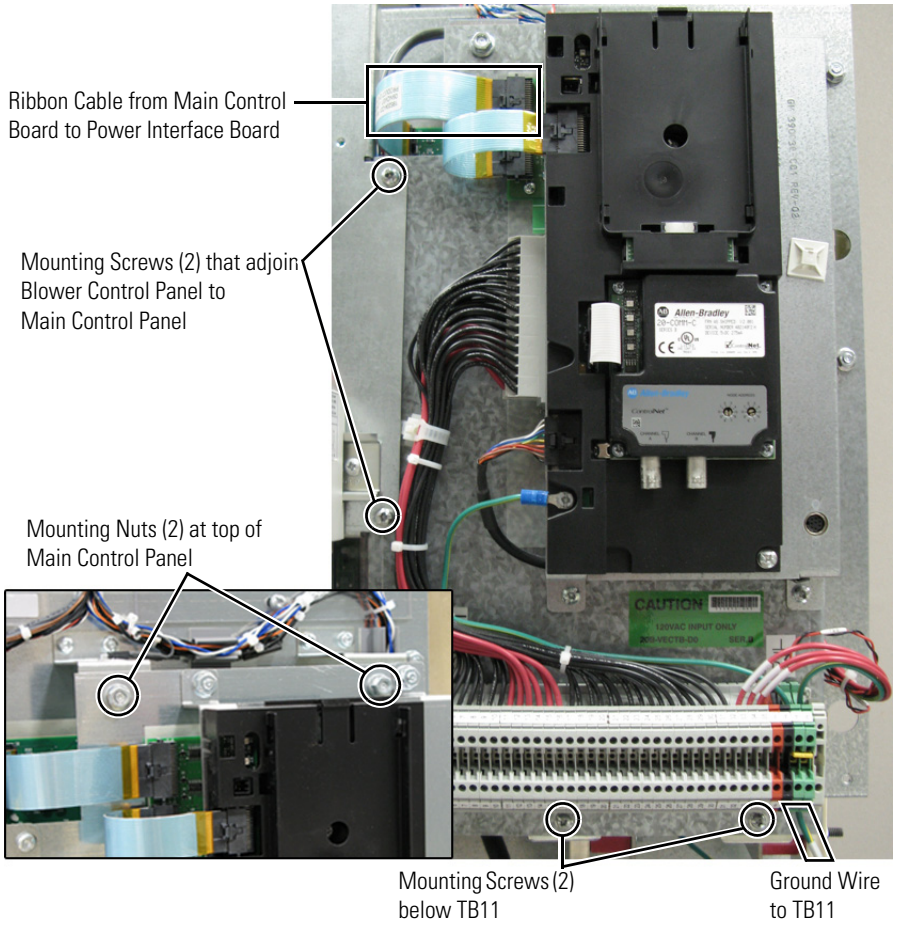


Main Control Panel

See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Remove safety shields as needed.



3. Remove the ribbon cable going from the Main Control Board (J2) to the Power Interface Board (J1).
4. Disconnect the incoming ground wire to TB11.
5. Remove the two mounting screws below TB11.
6. Remove the two screws that adjoin the Blower Control Panel to the Main Control Panel. These screws are larger than the two removed from below TB11 so do not mix the two sets.
7. Remove the two mounting nuts above the Main Control Board.
8. Remove Main Control Panel; support.

9. Disconnect wire harnesses from TB11 to:
   - J4 on the Switch Mode Power Supply Board
   - TB1 and TB2 on the Power Interface Board
10. Label and remove all customer wiring from TB11.
11. Carefully set aside the Main Control Panel.

Install Components

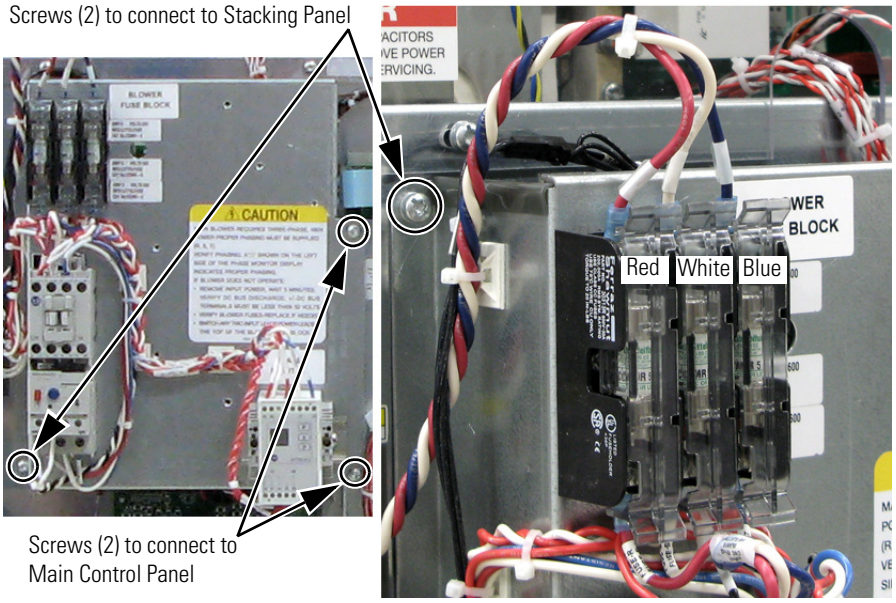
1. When instructed for the component you are replacing, reinstall the Main Control Panel Assembly components in the reverse order of removal.
2. Torque panel mounting screws to 2.9 N•m (26 lb•in).
3. Replace all safety shields and enclosure covers before applying power to the drive.

Blower Control Panel

See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Disconnect the three wires (red, white, and blue) at the top of the blower fuse block.



3. Label and remove all wiring to TB9.
4. Remove the two screws that connect the Blower Control Panel to the Main Control Panel.

   NOTE: These screws are already removed if the Main Control Panel has been removed.
5. Remove the two screws that connect the Blower Control Panel to the Stacking Panel.
6. Carefully set the Blower Control Panel aside.

Install Components

1. When instructed for the component you are replacing, reinstall the Blower Control Panel in the reverse order of removal.
2. See page 28 for reinstalling wires to TB9.
3. Torque panel mounting screws to 2.9 N•m (26 lb•in).
4. Replace all safety shields and enclosure covers before applying power to the drive.

Stacking Panel

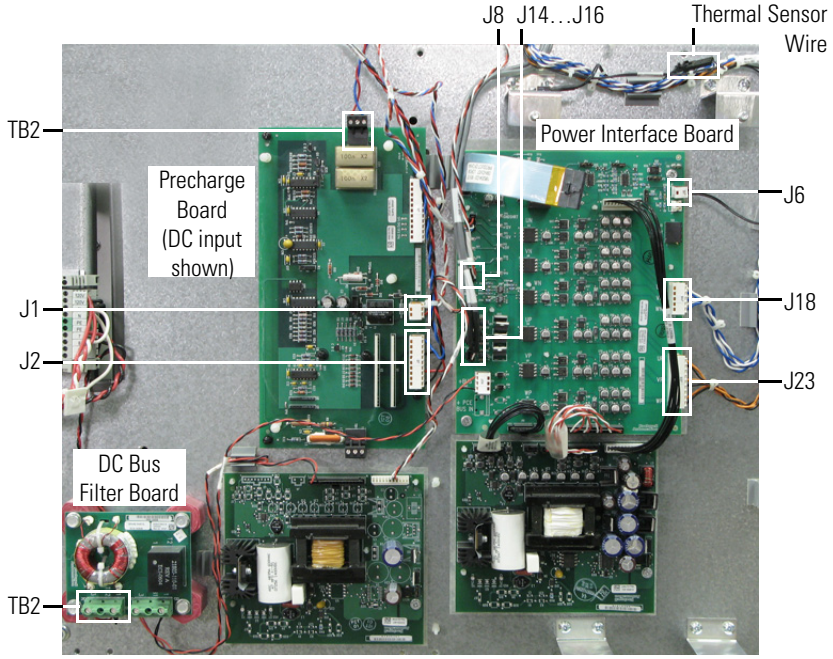
See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. All wiring and terminals attached to the Stacking Panel are shown below. Label any unidentified wiring and terminals before disconnecting.

IMPORTANT The figure below is shown with the Blower Control Panel removed for visual clarity. However, you don't need to remove the Blower Control Panel to remove the Stacking Panel.

Shown with Main Control Panel, Blower Control Panel and Safety Shield Removed



TIP This step may be performed more easily if you first remove the Communications Panel following the instructions on page 24.

Connected Component	Label on Wire or Connector	Label on Board	Notes
Precharge Board	J1, J2	J1, J2	
	TB2	TB2	For DC input only.
DC Bus Filter Board		TB2	
Thermal Sensor Wire			

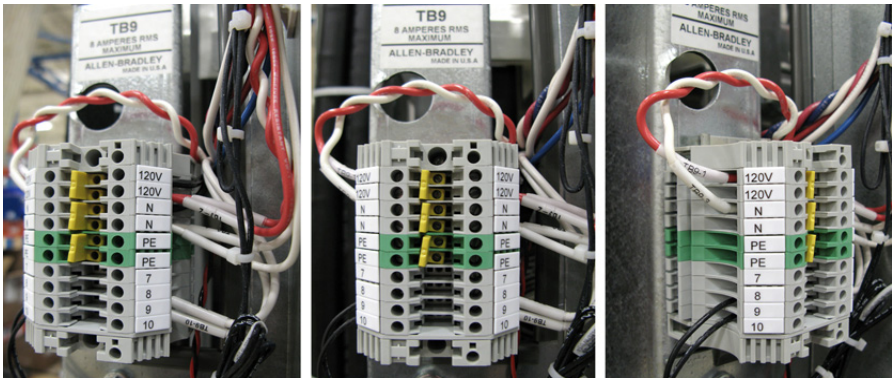
Connected Component	Label on Wire or Connector	Label on Board	Notes
Power Interface Board	J6	J6	
	J8	J8	
	J16	U	U Phase CT
	J15	V	V Phase CT
	J14	W	W Phase CT
	J23	UP, VP, WP	U, V, W positive gates
	J18	UN, VN, WN	U, V, W negative gates

3. Remove the J1 and J2 connectors on the Precharge Board.
4. **DC input only:** Remove the TB2 connector at the top of the Precharge Board.
5. Using your fingers or needle-nose pliers, squeeze the tabs of each of the four spacers and remove the safety shield over the DC Bus Filter Board and 24V Power Supply Board.
6. Disconnect the red and black wires from TB2 on the DC Bus Filter Board.

   Do not disconnect the wires from TB1.
7. Disconnect the black Main Control Panel Thermal Sensor Wire above the Main Control Board at the connector junction. See Figure 4 on page 17 for the location.

   Do not remove the sensor from the bracket.
8. Carefully label and disconnect all wiring to TB9.

TB9 Shown with Factory Wiring only

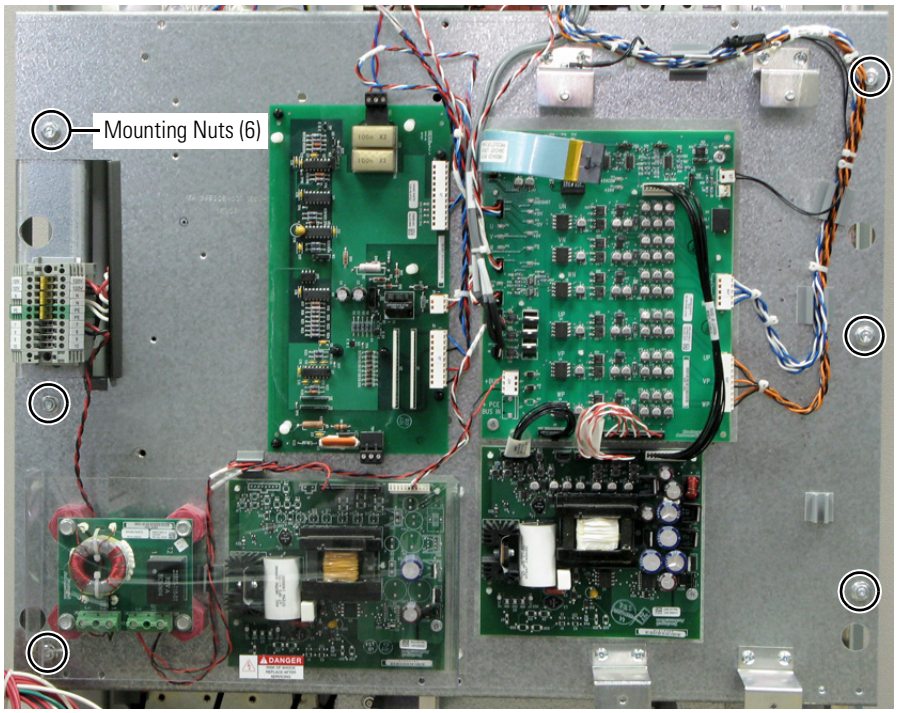


Connected Component	Wire Color	TB9 Terminal	Notes
Fan Harness	Black	120V, RT side	Lower 120V slot
	Black	N, RT side	Upper N slot
	Red	120V, LT side	Upper 120V slot
	White	N, LT side	Upper N slot
Blower Harness	White	TB-9, RT side	
	White	TB-10, RT side	

LT = Left and RT = Right

9. Remove the six nuts for mounting the Stacking Panel.

Shown with Main Control Panel and Blower Control Panel Removed



10. Remove Stacking Panel; carefully set aside.

Install Components

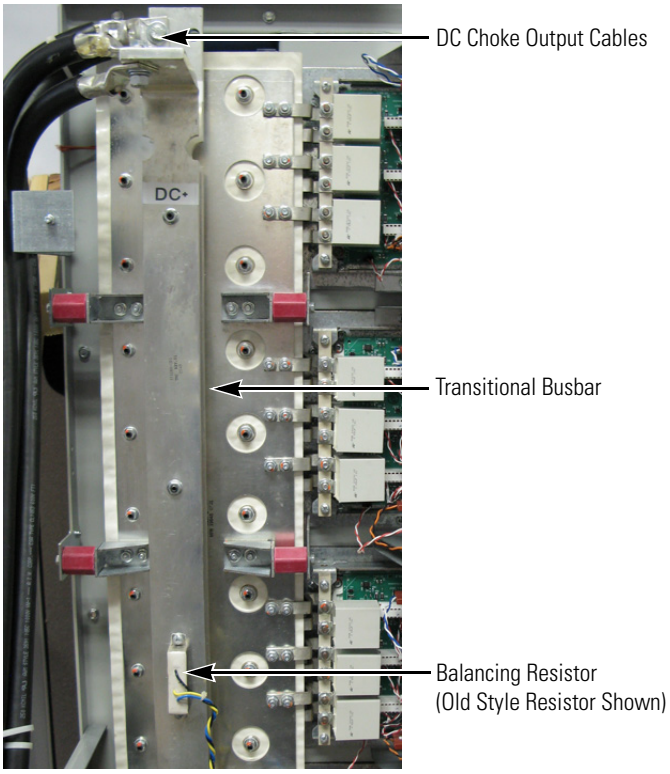
1. When instructed for the component you are replacing, reinstall the Stacking Panel components in the reverse order of removal.
2. Torque mounting screws to 5.6 N•m (50 lb•in).
3. Replace all safety shields and enclosure covers before applying power to the drive.

Transitional Busbar

See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Remove Main Control Panel on page 24.
3. Remove Blower Control Panel on page 26.
4. Remove Stacking Panel on page 27.
5. Locate the Transitional Busbar.

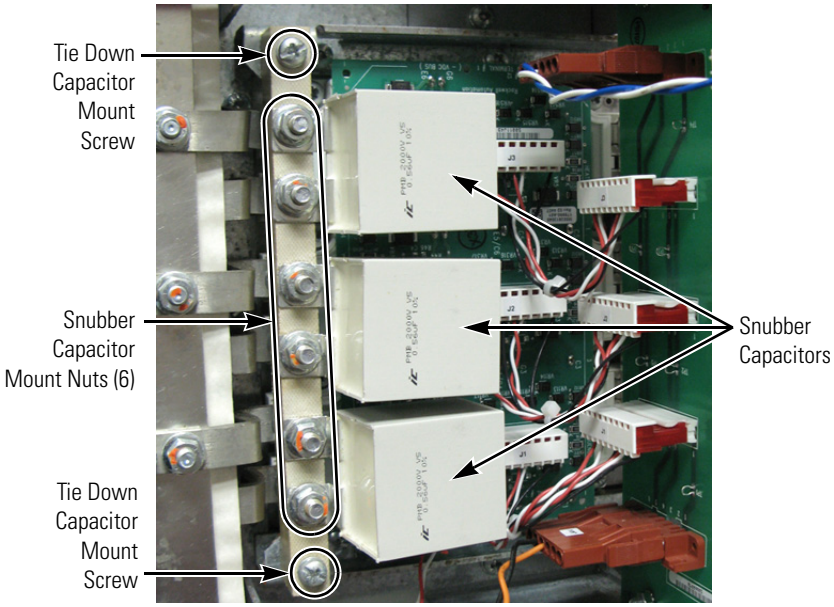


6. If present, remove all customer wiring to Transitional Busbar.
7. For AC input drives, remove the DC Choke output cables.

   For DC input drives, there is no choke.
8. If present, disconnect the +DC IN and +DC OUT cables from the Transitional Busbar.

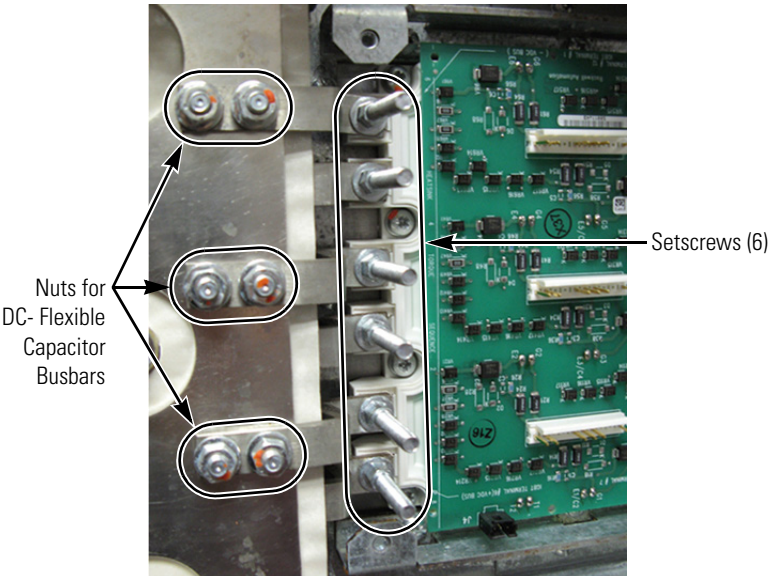
9. Remove all IGBT Snubber components.

a. Remove the six nuts that secure each set of Snubber Capacitors. Remove the capacitors, and save nuts and capacitors.



b. Remove the two screws that secure each Tie Down Capacitor Mount. Remove the Tie Down Capacitor Mounts and save screws and Capacitor Mounts.

c. Remove the six setscrews from each IGBT and save.

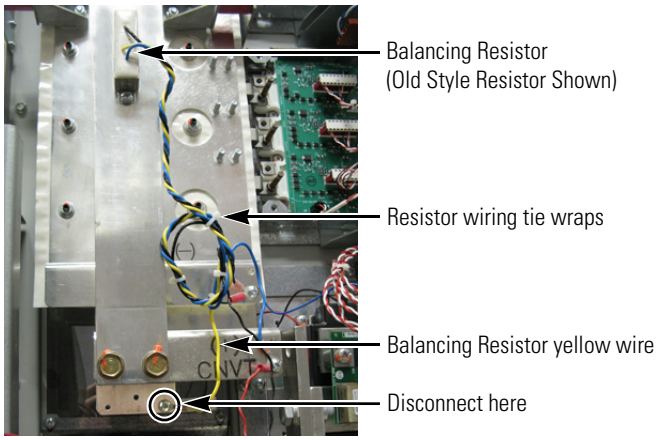


d. If replacing an IGBT module, remove the nuts and DC- Flexible Capacitor Busbars, and save nuts and busbars.

IMPORTANT	The positive (DC+) Flexible Capacitor Busbars are connected to the back side of the Transitional Busbar. The Transitional Busbar must be removed before they can be accessed and removed.

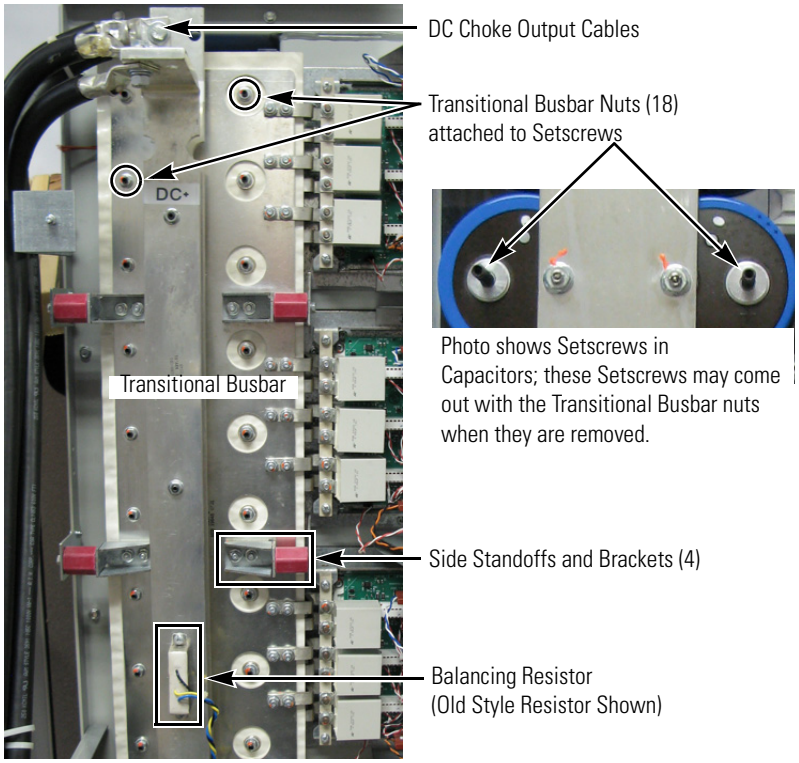
10. Cut tie wraps for the Balancing Resistor wiring.
11. Disconnect the yellow wire for the Balancing Resistor.

    You do not need to disconnect the blue and black wires.



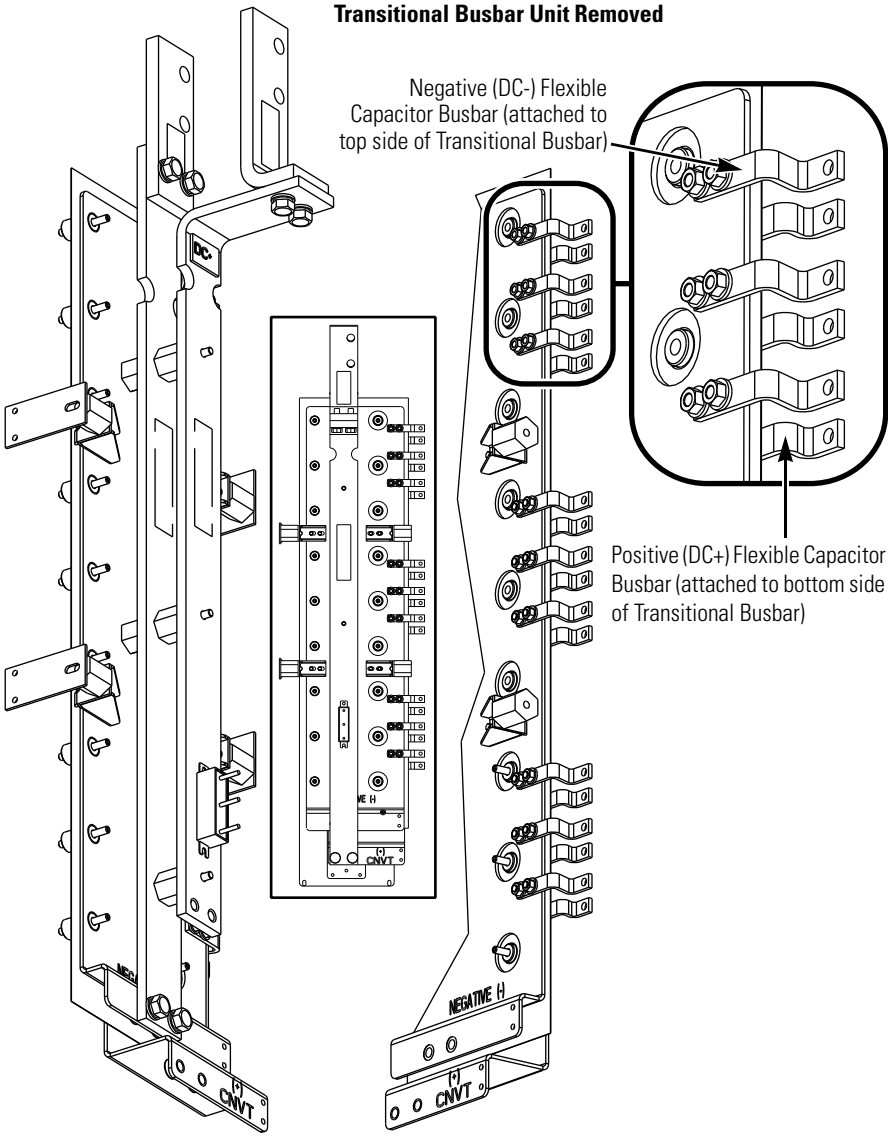
12. Remove the four side standoffs and brackets for the Transitional Busbar assembly.
13. Remove the 18 nuts fastening the Transitional Busbar assembly to the Bus Capacitors.

    Setscrews may come out with the nuts. Save all nuts and setscrews.



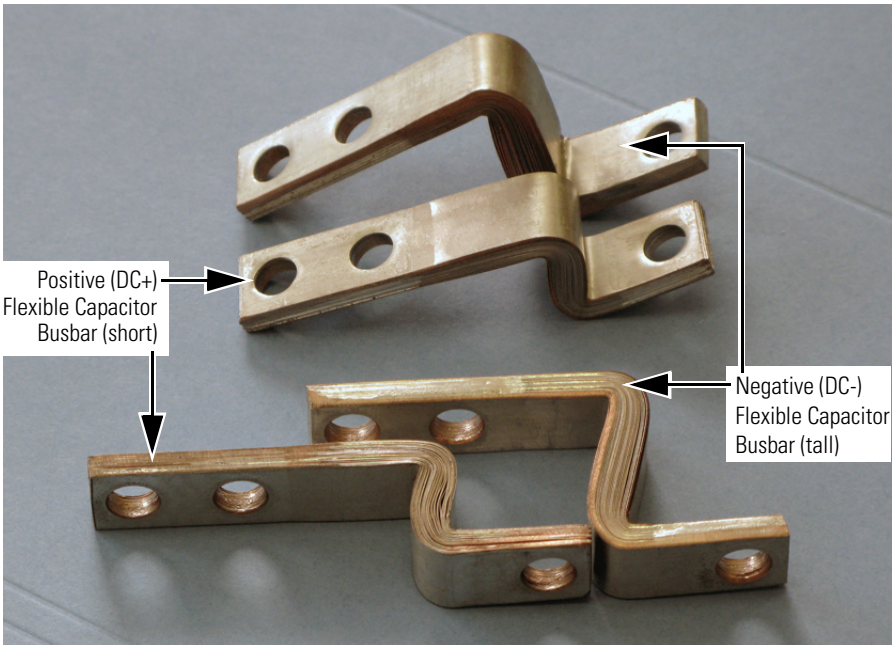
14. Remove the Transitional Busbar unit.

Transitional Busbar Unit Removed



Install Components

See the photographs in the Transitional Busbar section on page 30 to identify any components discussed in this section.



IMPORTANT Each IGBT replacement kit includes three positive (DC+) and three negative (DC-) Flexible Capacitor Busbars. The positive ones are shorter (see above) because they attach to the back side of the Transitional Busbar. For ease of installation, replace positive Flexible Capacitor Busbars while the Transitional Busbar is removed.

1. Replace the three positive (DC+) Flexible Capacitor Busbars supplied in an IGBT replacement kit on the back side of the Transitional Busbar for each IGBT module being replaced.
2. Mount Transitional Busbar to Bus Capacitors. If needed, use a rubber mallet to gently tap the Transitional Busbar onto the longer setscrews of the Bus Capacitors.
3. Add a washer (rounded side down) and nut to each Bus Capacitor setscrew. Finger tighten only.
4. Install the nine negative Flexible Capacitor Busbars to the Transitional Busbar with two washers (rounded side down) and two nuts for each Flexible Capacitor Busbar. Finger tighten only.
5. Install the six setscrews to secure the Flexible Capacitor Busbars to each IGBT board. Finger tighten only.

6. Reinstall the screws for the four side standoffs and brackets to secure the Transitional Busbar assembly to the chassis.
   a. Torque the screws to 5.6 N•m (50 lb•in) to secure the brackets to the four red glastic spacers.
   b. Torque screws to 2.9 N•m (26 lb•in) to secure the two brackets to the drive chassis.
7. Torque the six setscrews for each IGBT board to 5.6 N•m (50 lb•in).

IMPORTANT When torquing down each setscrew, place a flathead screwdriver against the side of the Flexible Capacitor Busbar to minimize twisting. **Do not** rest the screwdriver against any IGBT board while performing this task to avoid cracking or breaking the board.

8. Reinstall the Tie Down Capacitor Mount on each IGBT board.

   Reinstall two screws simultaneously to secure each Mount. Torque screws to 5.6 N•m (50 lb•in).
9. Install three Snubber Resistors onto the six setscrews for each IGBT board.

   Reinstall two screws to secure each Snubber Resistor against the Tie Down Capacitor Mount. Torque screws to 5.6 N•m (50 lb•in).
10. Torque the nuts that secure the nine negative Flexible Capacitor Busbars to the Transitional Busbar to 5.6 N•m (50 lb•in).
11. Torque the nuts that secure the Transitional Bus Bar to the Bus Capacitor setscrews to 5.6 N•m (50 lb•in).
12. Reconnect the yellow wire for the Balancing Resistor.
13. Install a new tie wrap for the Balancing Resistor wiring.
14. If present, reconnect the +DC IN and +DC OUT cables from the Transitional Busbar.
15. For AC input drives, reinstall the DC Choke output cables.
16. Reinstall any customer wiring to the Transitional Busbar.
17. Reinstall the Stacking Panel as instructed on page 29.
18. Reinstall the Blower Control Panel as instructed on page 26.
19. Reinstall the Main Control Panel as instructed on page 25.
20. Verify all wiring to the three panels and the Transitional Busbar has been reconnected.
21. Replace all safety shields and enclosure covers before applying power to the drive.

Notes:

Component Replacement Procedures

Overview

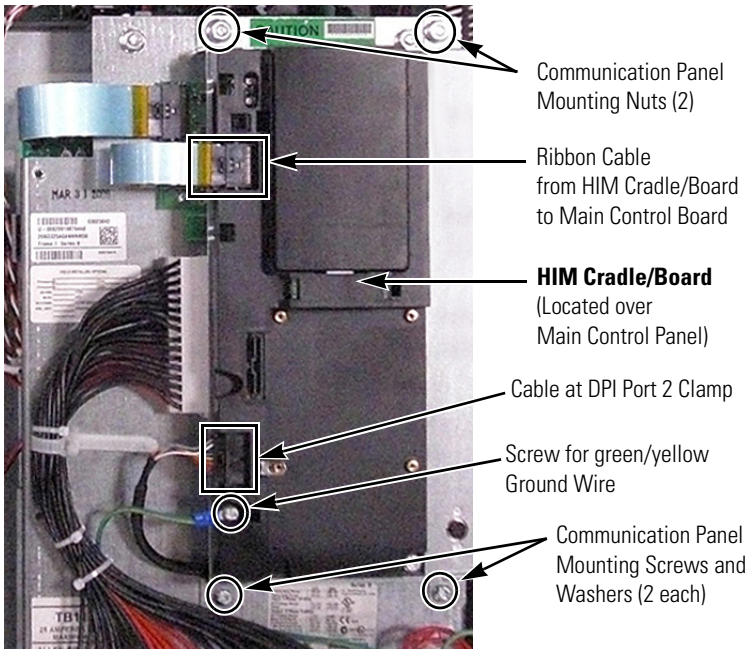
Component procedures detailed in this chapter apply to PowerFlex 700 Frame 9 drives for AC or DC input. Removal and replacement instructions for the Stacking Panel and Transitional Bar assemblies are detailed in Chapter 2.

Main Control Board

See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

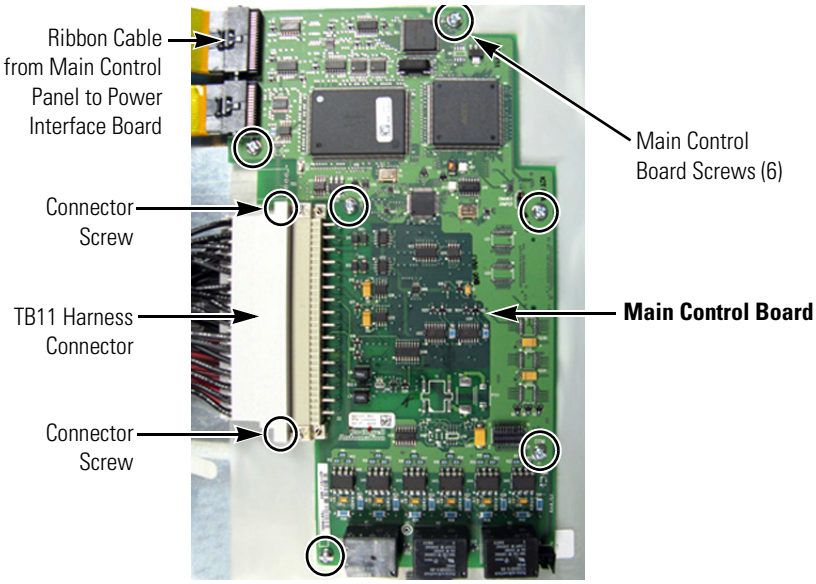
Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Remove safety shields as needed.



3. Unscrew the green/yellow ground wire from the Communications Panel.
4. Remove the nuts, screws and washers (two each) that secure the Communications Panel to the Main Control Panel.
5. Disconnect the ribbon cable that connects the HIM Cradle/Board to the Main Control Board.

6. Holding the Communications Panel, release the cable from the DPI Port 2 clamp and set the Communications Panel aside.



7. Disconnect the ribbon cable that connects the Main Control Board to the Power Interface Board.
8. Loosen the two connector screws for the TB11 Harness Connector on the Main Control Board.
9. Gently pull to disconnect the TB11 Harness Connector from the Main Control Board.

   Do not disconnect any Harness Connector wires from TB11.
10. If present, unscrew the two screws for the Encoder Board. Gently pull off the Encoder Board.
11. Unscrew the six screws and two hex standoffs (if Encoder Board is present) holding the Main Control Board.
12. If present, disconnect the J7 connectors for the Encoder Board.
13. Remove the Encoder Board and put aside to reinstall later.
14. Remove the Main Control Board; return or dispose of it properly.

Install Components

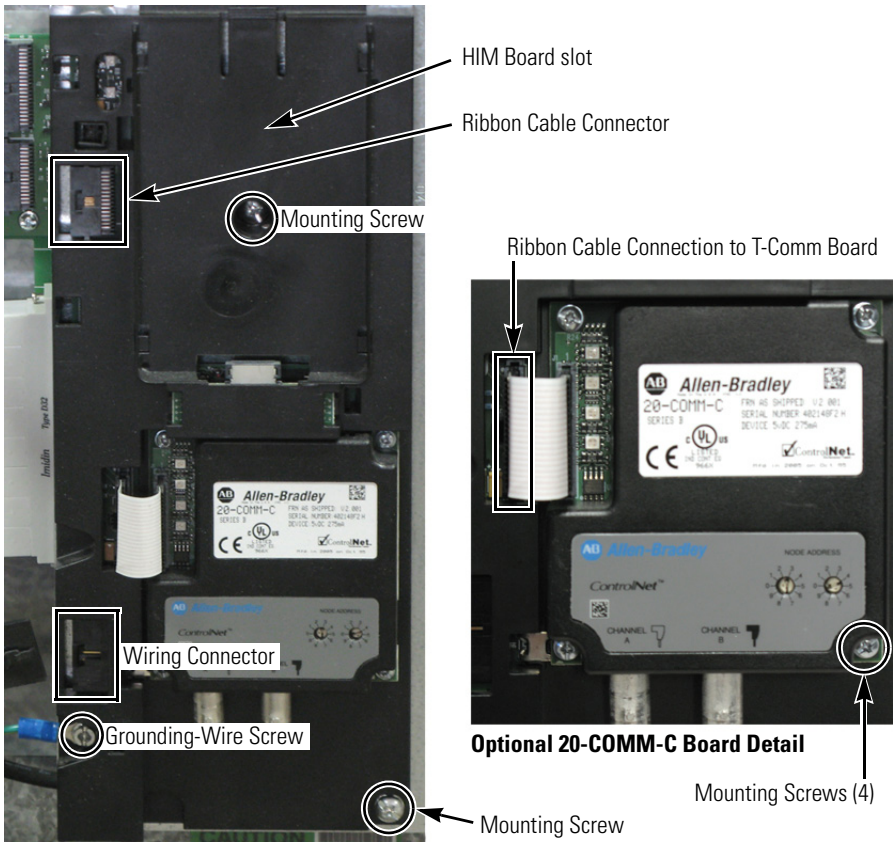
1. Install the new Main Control Board with six screws and two hex standoffs (if Encoder Board is present).
2. If present, reinstall the Encoder Board with two screws, taking care to match the J7 connectors.
3. Torque screws on Main Control Board and Encoder Board to 0.6 N•m (5 lb•in).
4. Reassemble all components in the reverse order of removal.
5. Reconnect all cables, safety shields and enclosure covers before applying power to the drive.

T-Comm Board

See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

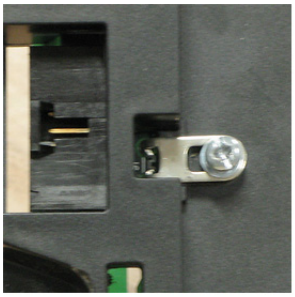
1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Remove the Main Control Board:
   a. Remove the HIM board from its slot (if used).
   b. Disconnect the ribbon cable from the Main Control Board (connects to J1on Power Interface Board).
   c. Disconnect the wiring connector from the Main Control Board (connects to 8-pin serial port in the lower-right corner of Main Control Board panel).
   d. Remove and save the grounding-wire screw (connects to PE on TB11).
   e. Remove and save the two mounting screws for the Main Control Board.
   f. Remove the Main Control Board.



3. Remove the 20-COMM-C Board (if used):
   a. Disconnect the ribbon cable between the 20-COMM-C Board and T-Comm board; disconnect only from the T-Comm board.

b. Remove and save the four mounting screws.

4. If the 20-COMM-C Board is not used, remove the screw securing the T-Comm grounding tab.

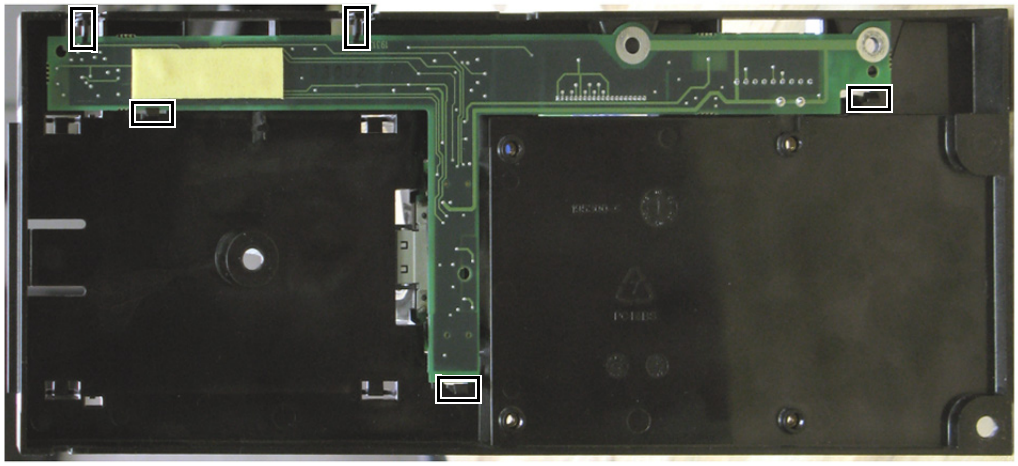

T-Comm grounding tab screw

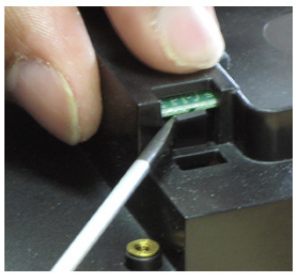
T-Comm grounding tab flat

T-Comm grounding tab upright

5. Place the tip of a flathead screwdriver between the T-Comm grounding tab and screw mount. Gently pry up until the grounding tab is in an upright position or about 90 degrees from the screw mount.

6. If needed, use the same flathead screwdriver tip to pry the seven locking tabs away from the T-Comm Board.





T-Comm Board Locking Tab Locations

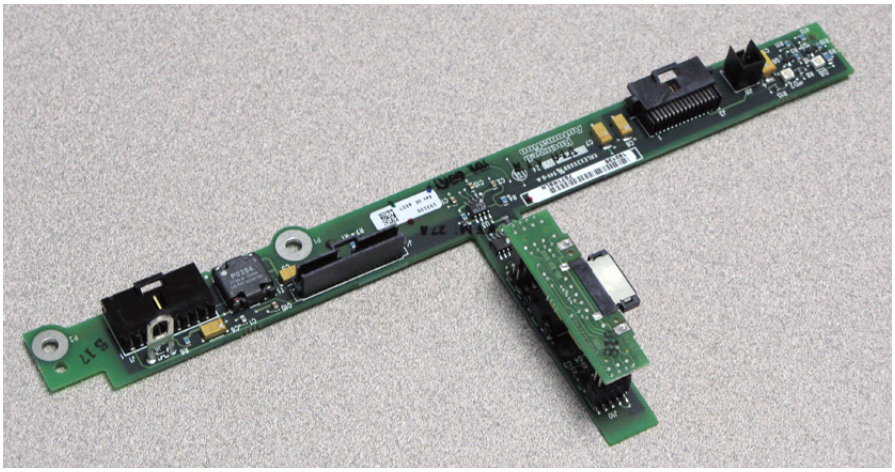
Five locking tabs are on the back side of the Main Control Board (above); two are on the front side in the area between the optional HIM and 20-COMM-C board slots (upper right).

NOTE: Use a flathead screwdriver tip to pry the locking tabs away from the T-Comm Board (lower right).

7. Remove the T-Comm Board from the Main Control Board; return or dispose of it properly.

Install Components

1. Install the new T-Comm Board.



2. Verify the board is locked into all seven locking tabs.
3. Carefully bend the T-Comm grounding tab until it is flush with the screw mount on the Main Control Board.
4. Reassemble all components in the reverse order of removal.
5. Reconnect all cables, safety shields and enclosure covers before applying power to the drive.

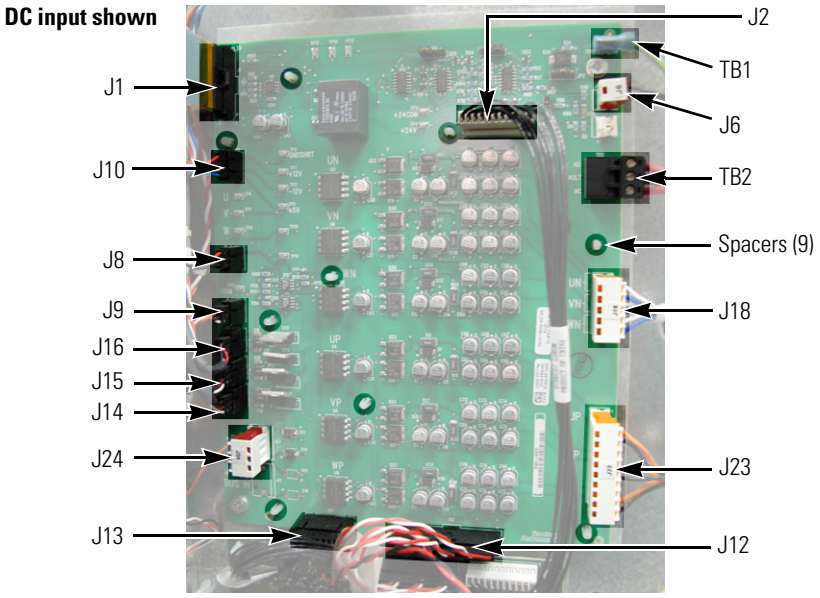
Power Interface Board

See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

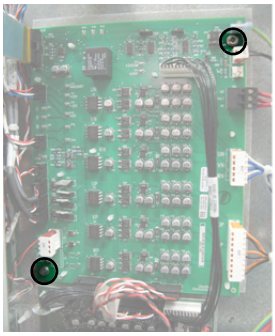
1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Remove the Main Control Panel. See page 24 for details.

3. Remove wiring to this Board, and wiring from this board to the Switch Mode Power Supply Board.



Connector	Wire Color(s)	Connects To:
J1	Ribbon	J2 on Main Control Board (ribbon cable)
J2	Black	J1 on Switch Mode Power Supply Board
J6	Black	Monitor wire to thermal sensors
J8	Red/White/Black	J7-U on U Phase Gate Interface Board
J9	Red/White/Black	J1 on 24V Power Supply Board
J10	Red/Black/White/Blue	J3 on Precharge Board
J12	Red/White	J3 on Switch Mode Power Supply Board
J13	Black	J2 on Switch Mode Power Supply Board
J14	Red/White/Black	U Phase Current Transducer
J15	Red/White/Black	V Phase Current Transducer
J16	Red/White/Black	W Phase Current Transducer
J18	Blue/White	U, V, W negative (–) gates (lower phase)
J23	Orange/Black	U, V, W positive (+) gates (upper phase)
J24	Red/Black	J1 on Precharge Board, TB1 on DC Bus Filter Board (AC input only)
		TB1 on DC Bus Filter Board (DC input only)
TB1	Green/Yellow	PE on TB11
TB2	Red	#33, #34, and #35 on TB11

4. Remove the two mounting torx screws located at the upper right and lower left corners of the board as shown at right.
5. Using your fingers or needle-nose pliers, squeeze the tabs of each of the nine spacers (see previous page for their locations), and separate the Power Interface Board from the mounting plate.
6. Remove the Power Interface Board; return or dispose of it properly.



Install Components

1. Install the new Power Interface Board.
   Tighten board screws to 1.7 N•m (15 lb•in).
2. Reconnect all wiring as detailed in the Table on the previous page.
3. Reconnect the Main Control Board wires to TB1 and TB2 on the Power Interface Board.

   Tighten sheet metal screws to 3.2 N•m (28 lb•in).
4. Reconnect the ribbon cable going from the Power Interface Board (J1) to the Main Control Board (J2).
5. Reinstall the Main Control Board as instructed on page 38.
6. Replace all safety shields and enclosure covers before applying power to the drive.

Switch Mode Power Supply Board

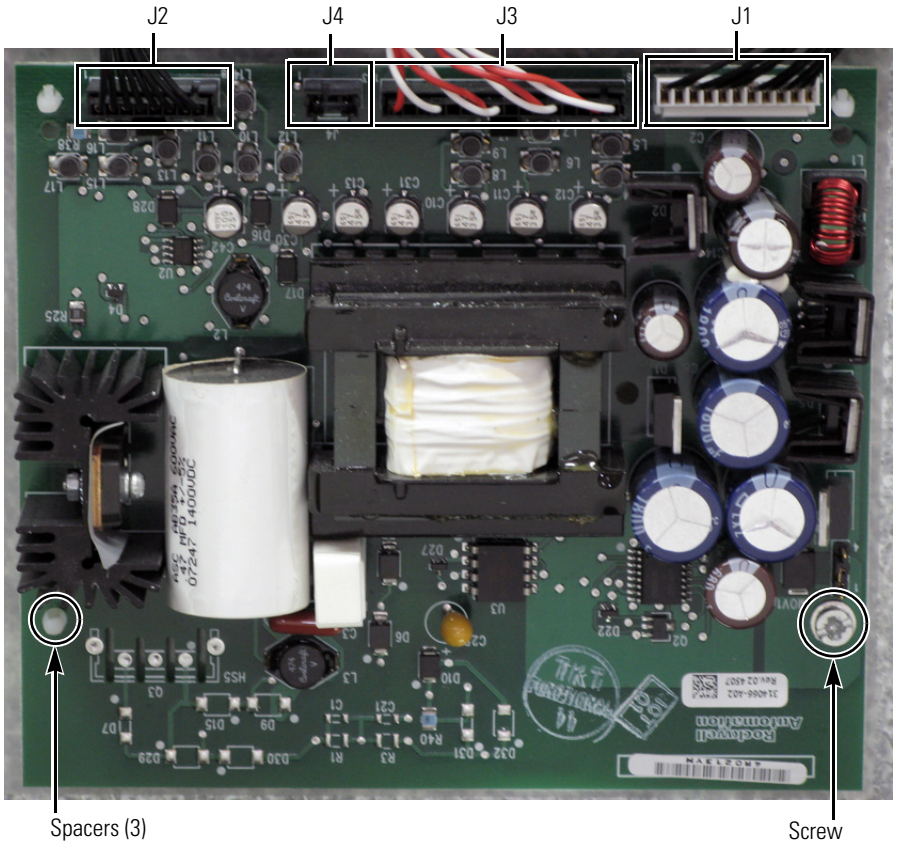
See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Remove the Main Control Panel. See page 24 for details.
3. Disconnect all wiring from the Switch Mode Power Supply Board.

Connector	Wire Color(s)	Connects To:
J1	Black	J2 on Power Interface Board
J2	Black	J13 on Power Interface Board
J3	Red/White	J12 on Power Interface Board
J4	N/A	Open

4. Remove the Switch Mode Power Supply Board mounting torx screw located at the lower right corner of the board.



5. Using your fingers or needle-nose pliers, squeeze the tabs of each of the three spacers and separate the Switch Mode Power Supply Board from the mounting plate.
6. Remove the Switch Mode Power Supply Board; return or dispose of it properly.

Install Components

1. Install the new Switch Mode Power Supply Board.

   Tighten board screws to 1.7 N•m (15 lb•in).
2. Reconnect all wiring as detailed in the Table on the previous page.
3. Reassemble all components in the reverse order of removal.
4. Tighten sheet metal screws to 3.2 N•m (28 lb•in).
5. Reconnect the ribbon cable going from the Power Interface Board (J1) to the Main Control Board (J2).
6. Reinstall the Main Control Board as instructed on page 38.
7. Replace all safety shields and enclosure covers before applying power to the drive.

24V Power Supply Board (for Current Transducers)

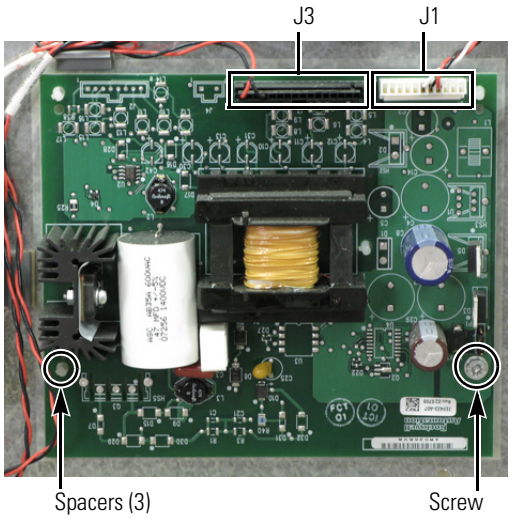
See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Remove the Main Control Panel. See page 24 for details.
3. Remove the safety shield over the 24V Power Supply Board.
4. Disconnect all wiring from the 24V Power Supply Board.

Connector	Wire Color(s)	Connects To:
J1	Red/White/Black	J9 on Power Interface Board
J3	Red/Black	TB1 on DC Bus Filter Board

5. Remove the mounting torx screw located at the lower right corner of the board.
6. Using your fingers or needle-nose pliers, squeeze the tabs of each of the three spacers and separate the board from the mounting plate.
7. Remove the 24V Power Supply Board; return or dispose of it properly.



Install Components

1. Install the new 24V Power Supply Board.

   Tighten the torx screw to 1.7 N•m (15 lb•in).
2. Reconnect all wiring as detailed in the Table on previous page.
3. Replace all safety shields and enclosure covers before applying power to the drive.

Precharge Board

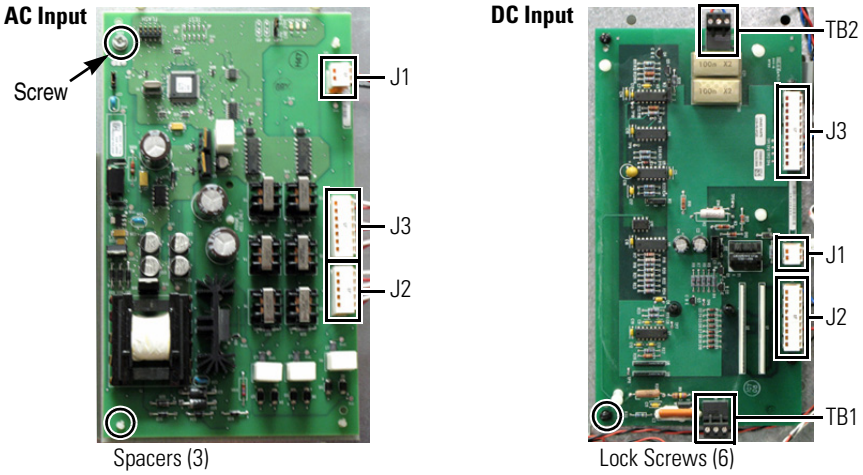
See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Remove the Blower Control Panel. See page 26 for details.
3. For DC input: Label customer wiring to TB2 and then disconnect TB2.
4. Disconnect the all wiring from the Precharge Board.

Connector	Wire Color(s)	Connects To:
AC Input		
J1	Red/Black	J24 (+BUS IN) on Power Interface Board
J2	Red/White	Converter SCR Modules (R, S, T)
J3	Red/White	Converter SCR Modules (R, S, T)
DC Input		
J1	Red/White	Precharge SCR Module
J2	Blue	Precharge +DC In Busbar
	Red	Precharge +DC Out Busbar
	Black	DC- Bus Capacitor
J3	Red/White	J10 on Power Interface Board
TB1	N/A	Open
TB2	Blue	+DC In Busbar
	Red	+DC Out Busbar

Note: Label unidentified connectors to simplify reinstallation.



5. For AC input: Remove the Precharge Board mounting torx screw located at the upper left corner of the Precharge Board.
6. Remove the Precharge Board; return or dispose of it properly.
   - **For AC input:** Using your fingers or needle-nose pliers, squeeze the tabs of each of the three spacers and separate the Precharge Board from the mounting plate.
   - **For DC input:** Turn each of the six lock screws 1/4 turn counterclockwise to unlock.

Install Components

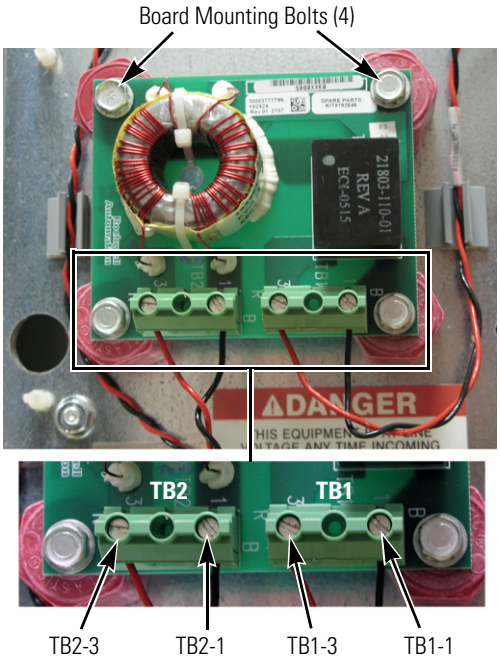
1. Install the new Precharge Board.
2. Reconnect all wiring as detailed in the Table on the previous page.
3. Reinstall the Blower Control Panel as instructed on page 26.
4. Replace all safety shields and enclosure covers before applying power to the drive.

DC Bus Filter Board

See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Remove the safety shield over the DC Bus Filter Board.
3. Disconnect all wiring from TB1 and TB2 terminals.



Connector	Wire Color(s)	Connects To:
TB1-1	Black	J24 on Power Interface Board
TB1-3	Red	J24 on Power Interface Board
TB2-1	Black	DC- Bus Capacitor
TB2-3	Red	DC+ Bus Capacitor

4. Remove the four board mounting bolts.
5. Remove the DC Bus Filter Board; return or dispose of it properly.

Install Components

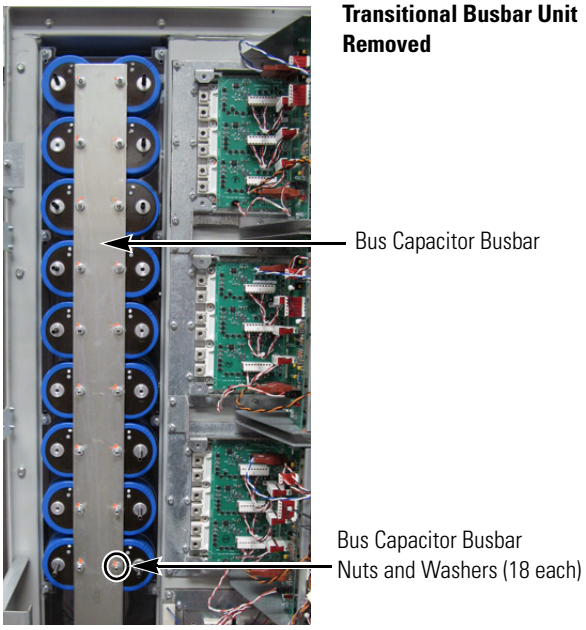
1. Install the new DC Bus Filter Board. Torque mounting bolts to 1.7 N•m (15 lb•in).
2. Reconnect all wiring as detailed in the above Table.
3. Replace all safety shields and enclosure covers before applying power to the drive.

Bus Capacitor

See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Remove the Main Control Panel. See page 24 for details.
3. Remove the Stacking Panel. See page 27.
4. Remove the Transitional Busbar. See page 30 for details.



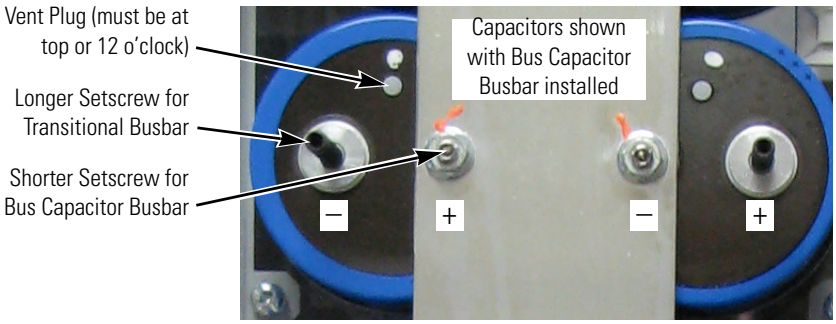
5. Label and remove all wires and connectors from the Bus Capacitor Busbar.
6. Remove nuts and washers (18 each) fastening the Bus Capacitor Busbar to the Bus Capacitors.

   The setcrews may come out with the nuts. Save all nuts and setscrews.
7. Remove the Bus Capacitor Busbar.
8. Remove Capacitors by pulling them out; dispose of them properly.

Install Components

ATTENTION: Install each capacitor so its **vent plug is at the top** or 12 o'clock. Component and system damage may result if you position any Bus Capacitor incorrectly.

1. Replace setscrews for each new Capacitor using a 3 mm angle hex wrench. Each Capacitor needs a short and long setscrew; see the illustration below for where to install each one.



2. Place Capacitors into correct position in drive (**vent plug at top** or 12 o'clock).
3. Place Bus Capacitor Busbar onto Capacitors.
4. Install washers and nuts onto the shorter setscrews to secure the Bus Capacitor Busbar to the Bus Capacitors.

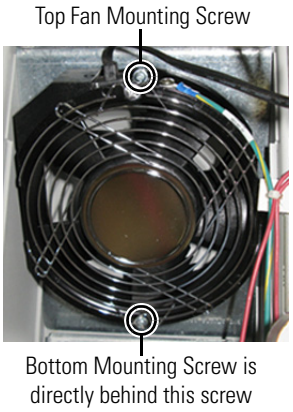
   Note: Install all setscrews, washers, and nuts but do not tighten yet.
5. Place the Transitional Busbar in position, but do not install yet. Verify the Bus Capacitor setscrews, Flexible Capacitor Busbars, and all washers and nuts fit. Adjust as needed.
6. Remove the Transitional Busbar, and tighten all washers and nuts for the Bus Capacitor Busbar. Torque to 5.6 N•m (50 lb•in).
7. Install the Transitional Busbar according to the instructions on page 34.
8. Reconnect all wires and connectors.
9. Reassemble remaining components in reverse order.
10. Replace all safety shields and enclosure covers before applying power to the drive.

Capacitor Bank Fan

See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Remove the Main Control Panel. See page 24 for details.
3. Remove the Stacking Panel. See page 27.
4. Locate the Capacitor Bank Fan.
5. Label and disconnect all wires for the fan.
6. Remove the top and bottom mounting screws.
7. Remove the fan assembly and dispose of it properly.



Install Components

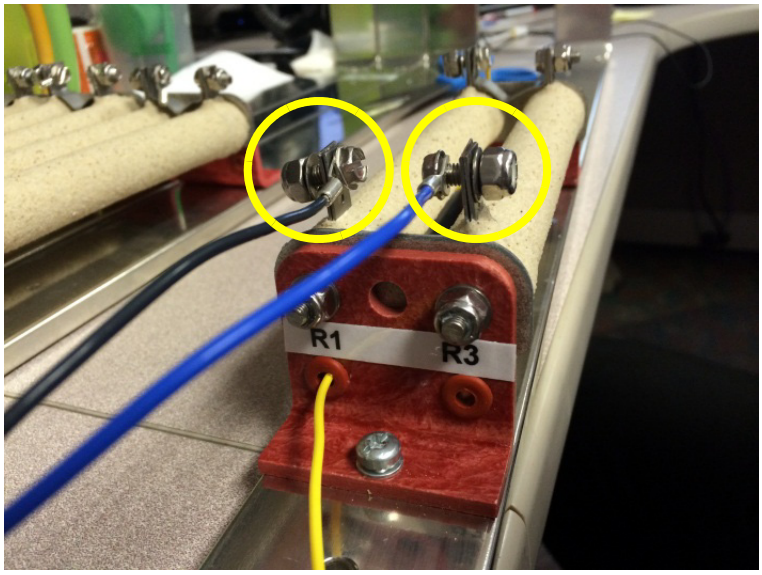
1. Install the new fan assembly. Hand tighten the two mounting screws.
2. Reconnect wires.
3. Torque the two mounting screws to 2.9 N•m (26 lb•in).
4. Reassemble remaining components in reverse order.
5. Replace all safety shields and enclosure covers before applying power to the drive.

Balancing Resistor and DC+ Bus Bar

See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

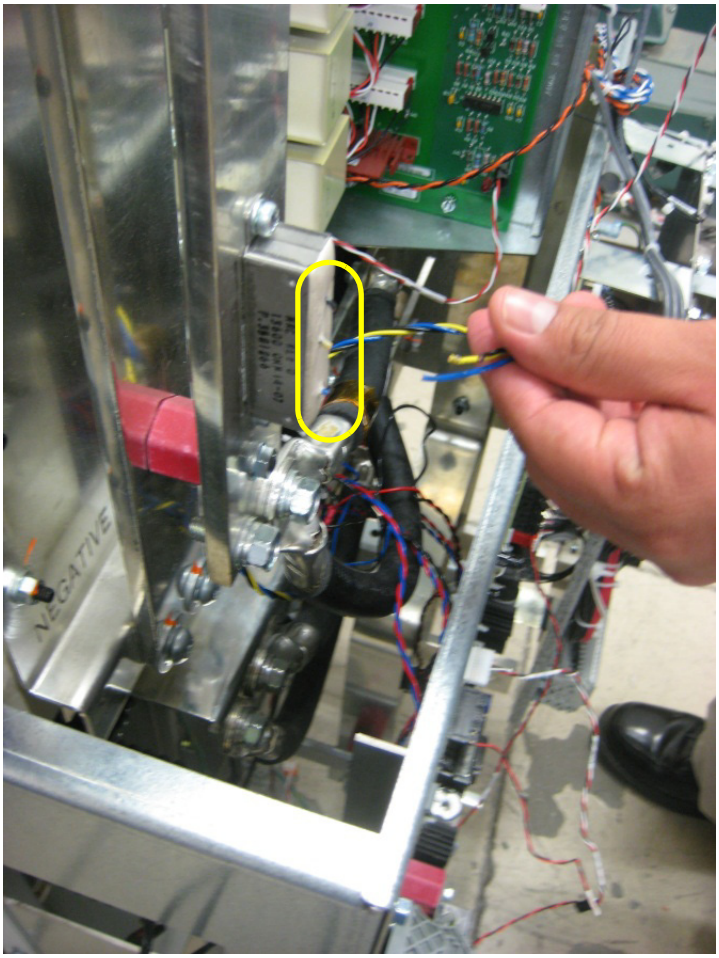
Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Remove the Main Control Panel. See page 24 for details.
3. Remove the Stacking Panel. See page 27.
4. Verify the rating of the resistors to be sure there was no damaged during shipment (R1 to R2 = R2 to R3 = 6.8 kΩ ±5%).



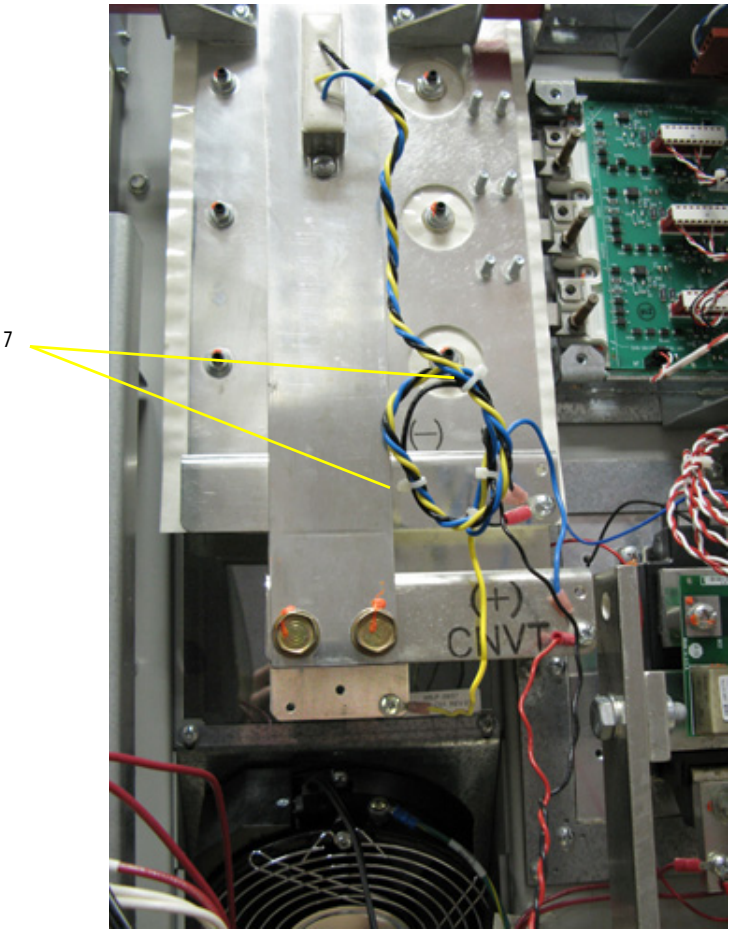
IMPORTANT Do not install the resistor if the measurement is not within the recommended range.

5. Because the existing resistor wires will be reused, cut the wires off of the resistor at the solder joint, to keep the wires as long as possible.



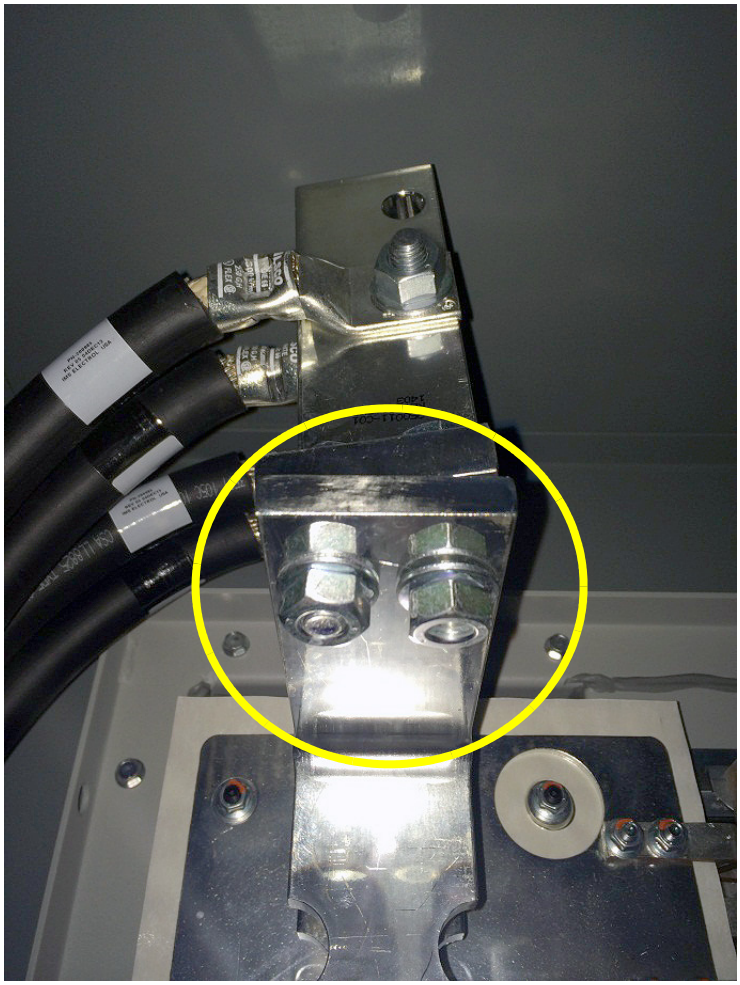
6. Strip the tip of each wire to approximately 6 mm (0.24 in.).

7. Cut and remove the tie wraps that secure the resistor wire bundle.

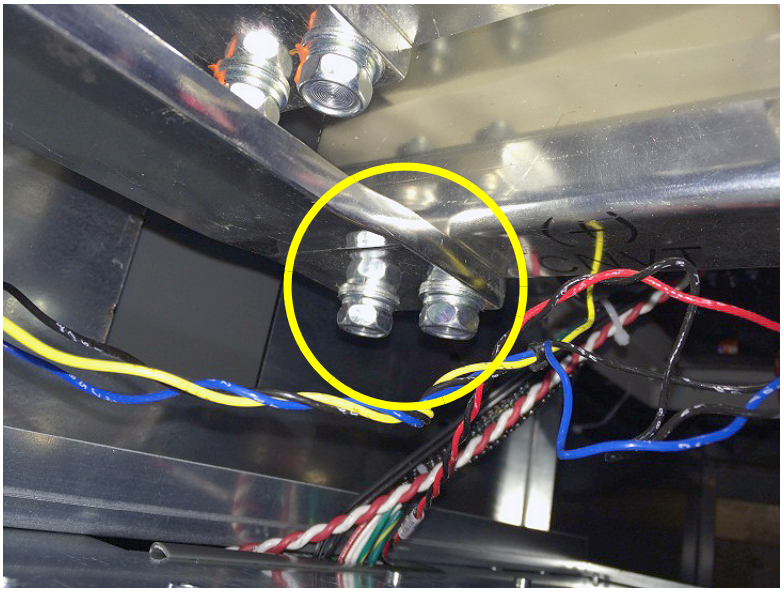


8. Remove the bolts between the right-angled bus bar and the large bus bar.

IMPORTANT	Do not remove the bolts that attach the cables to the right-angled bus bar.

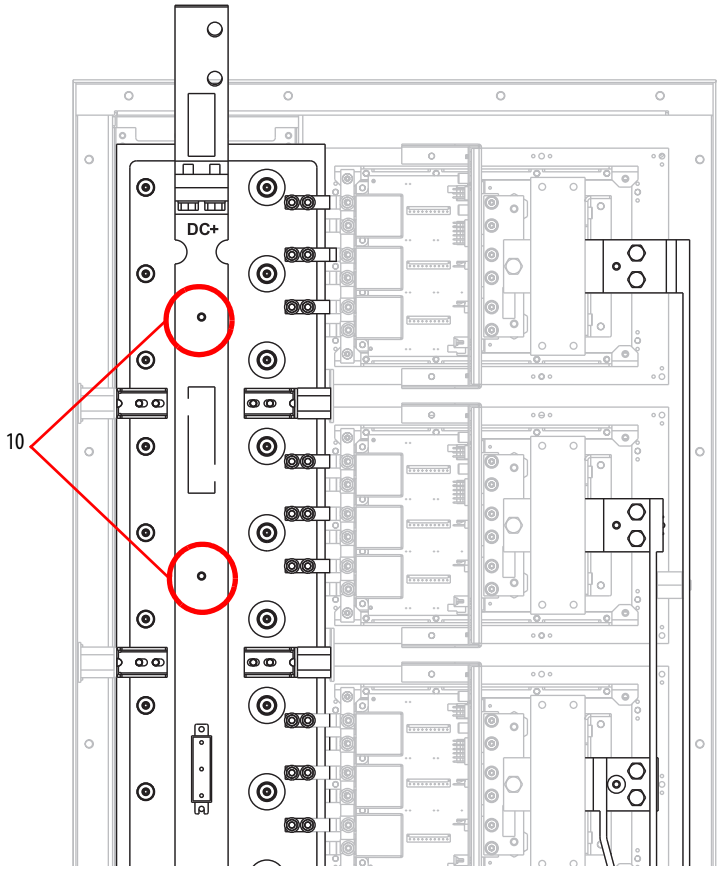


9. Remove the two bolts from the bottom of the bus bar (as shown in the following image).



10. While holding the bus bar, remove the nuts that secure the bus bar to the chassis and remove the bus bar.

IMPORTANT The set screws can come out when a nut is removed.

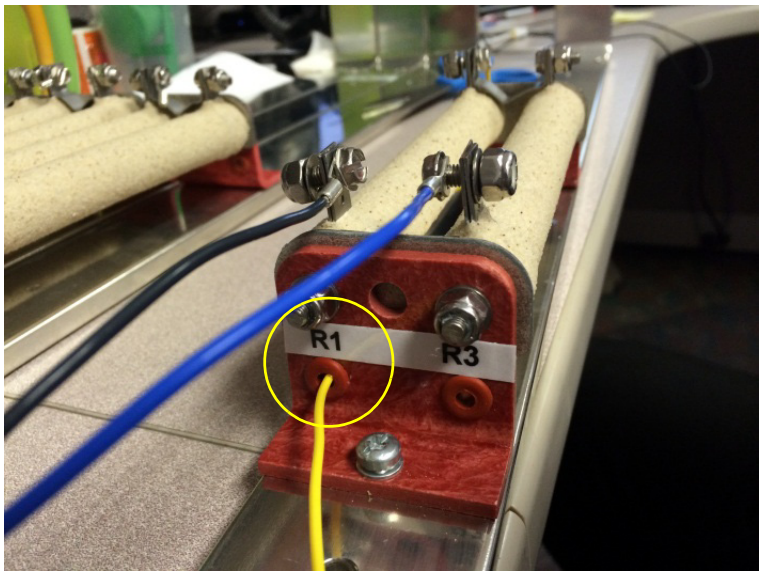


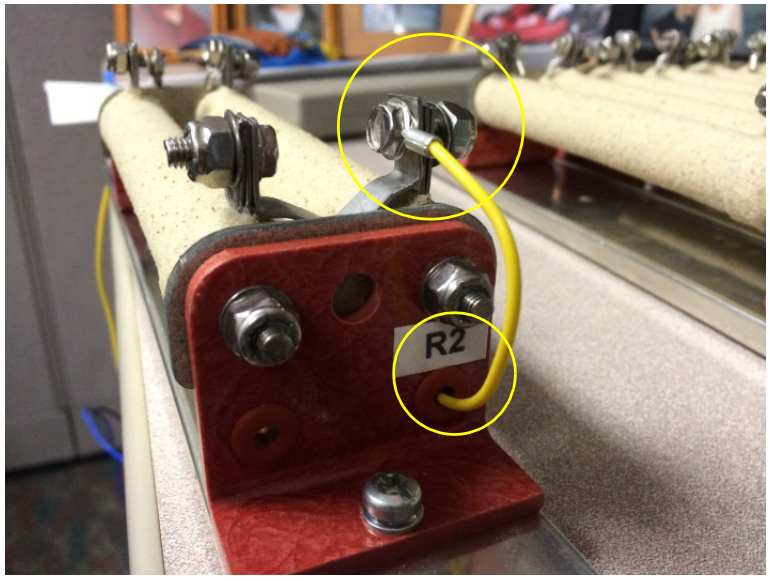
Install Components

1. Install the set screws and nuts removed in step 10 on page 58. Tighten the nuts to 5.65 N•m (50 lb•in).
2. Install the bolts removed in step 9 on page 57. Tighten the bolts to 23.5 N•m (208 lb•in).
3. Install the bolts removed in step 8 on page 56. Tighten the bolts to 23.5 N•m (208 lb•in).

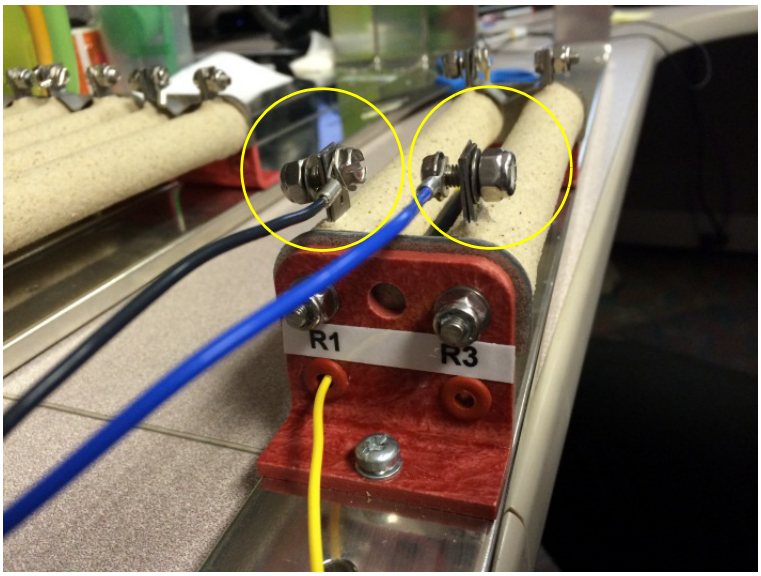
4. Verify that the yellow resistor wire is long enough to connect to the left terminal (R2) on the top of the resistor assembly. To do so, route the wire through the bottom and out of the top of the holes in the insulator material on the resistor assembly (as shown in the following images).

   Note: If the yellow resistor wire is not long enough to reach the top terminal (R2) when routed through the assembly, it is acceptable to leave the wire outside of the assembly to make the connection.

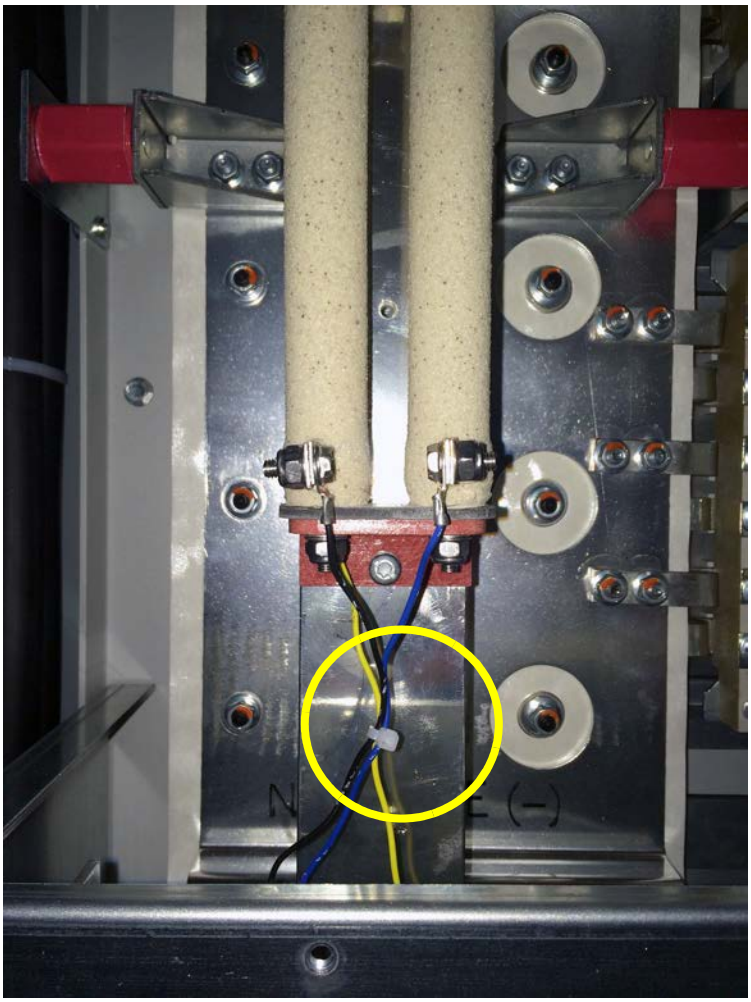




5. Remove the lugs from the resistor terminals and, using an 18 AWG wire crimper for a non-insulated connector, crimp the wires to the lugs.
6. Secure the lug with the black resistor wire to the left terminal (R1) on the bottom of the resistor assembly.
7. Secure the lug with the blue resistor wire to the right terminal (R3) on the bottom of the resistor assembly.
8. Secure the lug with the yellow resistor wire to the left terminal (R2) on the top of the resistor assembly.



9. Secure the resistor wire bundle below the assembly using tie-wraps (as shown in the following image).



10. Install the stacking panel as detailed on page 27.
11. Replace all safety shields and enclosure covers before applying power to the drive.

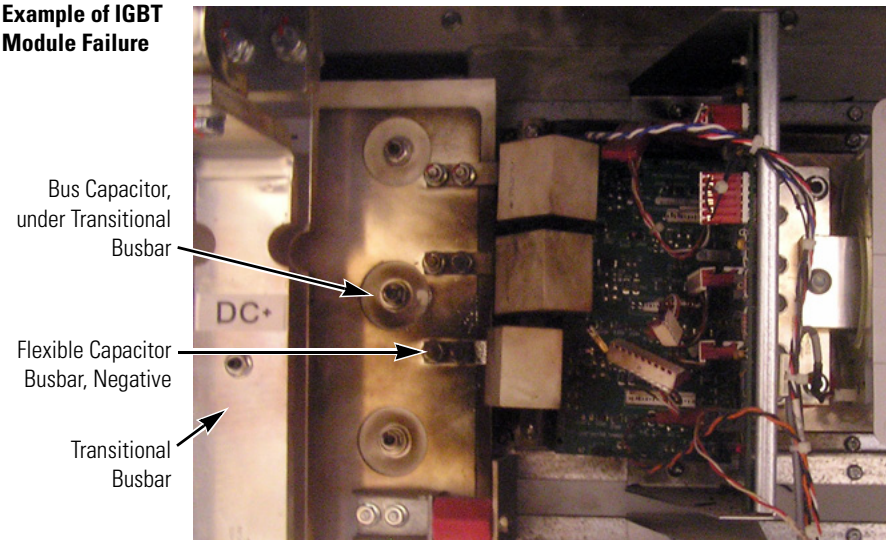
Inverter Power Module (IGBT)

Kit includes:

Qty	Component
1	IGBT module with circuit board
1	Gate Interface Board
1	Gate Interconnect Harness
3	Flexible Capacitor Busbar, Positive
3	Flexible Capacitor Busbar, Negative
1	Tie Down Capacitor Mount
3	Snubber Capacitor

This image is an example of an IGBT module failure. IGBT damage may impact other components near or associated with IGBT operation, including components that are not part of the aforementioned kit.

Example of IGBT Module Failure

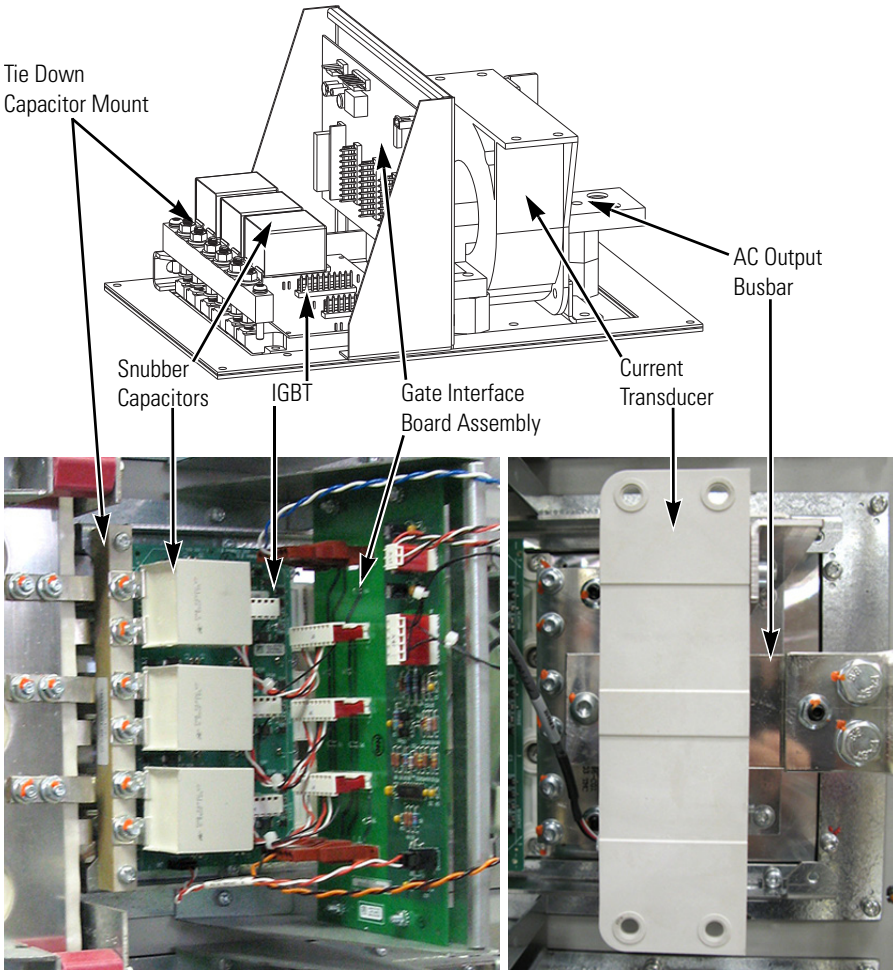


IMPORTANT If any IGBT module is damaged, all IGBT modules and associated components should be replaced. Perform the following procedure for all IGBT modules.

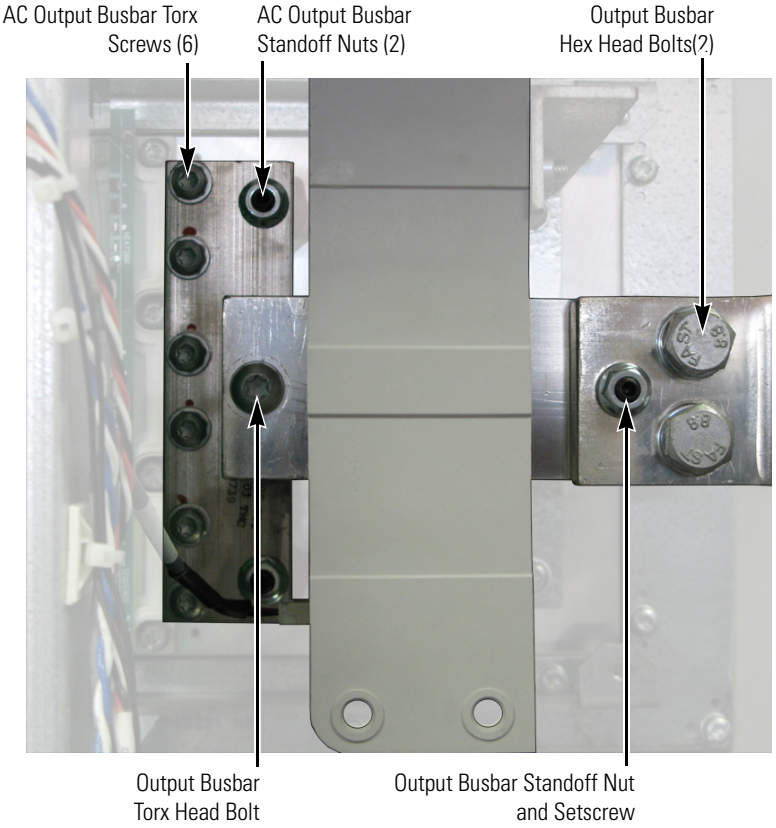
See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Locate the Inverter Power Module to be replaced.



3. Remove the Output Busbar at the Current Transducer.
   a. Remove and save the torx head bolt that secures the Output Busbar to the AC Output Busbar.
   b. Remove and save the two hex head bolts that secure the Output Busbar to the U, V or W Busbar.
   c. Remove and save the nut and setscrew for the Output Busbar standoff.
   d. Slide the Output Busbar to the right as far as it goes.
4. Remove the AC Output Busbar:
   a. Remove and save the six torx screws and two standoff nuts that secure the AC Output Busbar to the IGBT.
   b. Remove and save the two nuts that secure the AC Output Busbar to the standoffs.
   c. Remove and save the AC Output Busbar.



5. Remove all IGBT Snubber components. See page 31.
6. Remove the Gate Interface Board. See page 67 for details.
7. Remove the Transitional Busbar (see page 30) if the Bus Capacitors or the positive (DC+) Flexible Capacitor Busbars supplied with the kit must be installed.
8. Remove the eight screws that secure the IGBT to the chassis. Remove the IGBT by tipping the right edge out first; return or dispose of it properly.

Install Components

1. Carefully examine the Transitional Busbar and Bus Capacitors for damage.

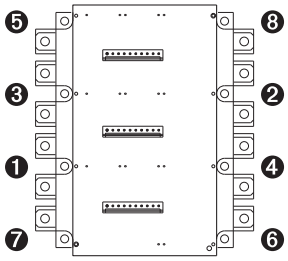
   When replacing any IGBT, it is recommended that you replace all Bus Capacitors. If needed, see Bus Capacitor on page 50 to replace damaged Bus Capacitors.

2. Install the IGBT module.
   a. Using isopropyl alcohol, thoroughly clean the surface of the Heatsink.
   b. Verify that the mounting surface of the new IGBT module is clean. If not, clean with isopropyl alcohol.
   c. Using a 3- or 4-inch paint roller or putty knife, apply a thin even coating of the supplied thermal grease to the mounting surface of the IGBT module.

      In the next step, take care to not disturb any of the thermal grease on the IGBT module.

IMPORTANT If the Transitional Busbar was not removed, take care to not damage the Flexible Capacitor Busbars fitting over and under the Transitional Busbar.

   d. Place the IGBT on the chassis with the serial number label at the top. Install with supplied screws using this torque sequence:



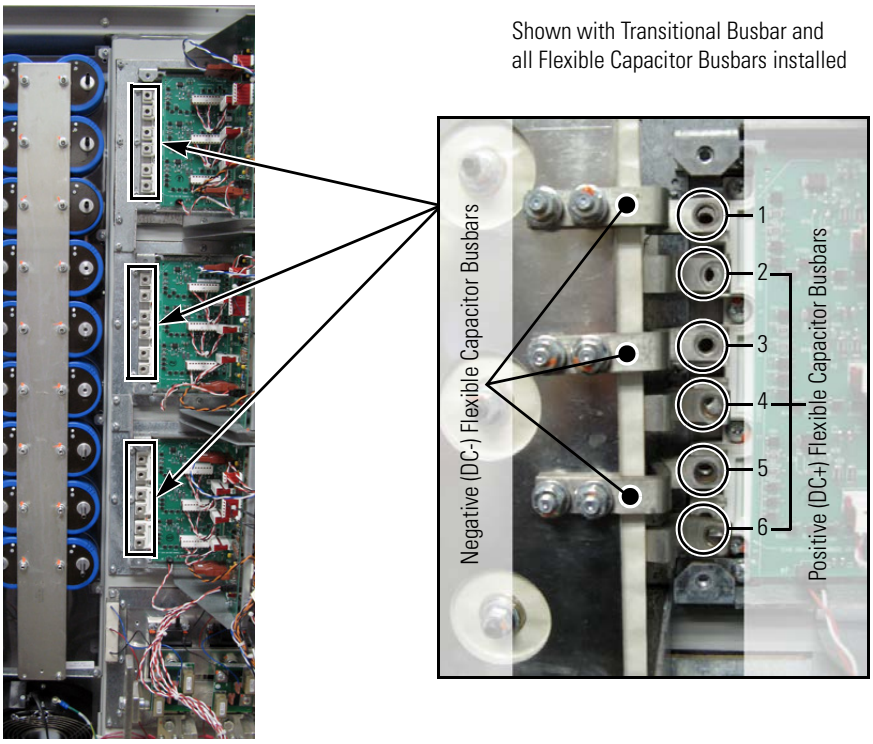
IGBT Torque Sequence

First Sequence: 0.7 N-m (6.0 lb.-in.)
Second Sequence: 2.3 N-m (20 lb.-in.)
Final Sequence: 5.6 N-m (50 lb.-in.)

IMPORTANT The three positive (+) Flexible Capacitor Busbars supplied with the kit must be installed on the back side of the Transitional Busbar before they can be installed on the IGBT. See page 34 for how to install these busbars on the Transitional Busbar.

3. If needed, install the three supplied positive (DC+) Flexible Capacitor Busbars on the back side of the Transitional Busbar.

   The positive (DC+) Flexible Capacitor Busbars have a shorter angle.



4. Reinstall the Transitional Busbar as instructed on page 34.
5. Install the three supplied negative (DC-) Flexible Capacitor Busbars in positions 1, 3, and 5 on the IGBT.

   The negative (DC-) Flexible Capacitor Busbars have a higher angle.
6. Install the Tie Down Capacitor Mount:
   a. Insert the short ends of the six threaded studs with nuts through the Flexible Capacitor Busbars and into the left side of the IGBT. Torque to 5.6 N•m (50 lb•in).

WARNING: Correct torque is critical to ensure correct operation of the drive. Improper torquing could cause premature failure when attempting to operate the drive.

   b. Install the Tie Down Capacitor Mount with the two screws previously removed from the top and bottom of the Capacitor Mount. Torque to 2.9 N•m (26 lb•in).
7. Install the Current Transducer, AC Output Busbar, and Output Busbar. See Install Components on page 70.

8. Install the Gate Interface Board:
   a. Install the Gate Interface Board using the four nuts removed previously. Torque screws to 2.9 N•m (26 lb•in).
   b. Install the supplied Gate Interconnect Harness.
   c. Connect wiring between the IGBT and Gate Interface Board as shown in Gate Interface Board on page 67.
   d. Connect wires to the Current Transducer.
9. Install the three Snubber Capacitors in the reverse order of Remove all IGBT Snubber components. See page 31.

   Torque nuts to 5.6 N•m (50 lb•in).
10. Reassemble remaining components in reverse order.
11. Replace all safety shields and enclosure covers before applying power to the drive.

Gate Interface Board

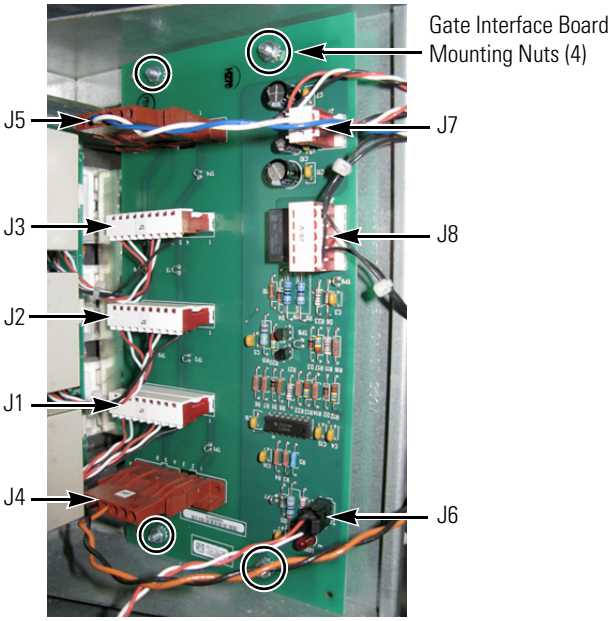
See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Locate the Gate Interface Board to be replaced.
3. Remove the safety cover over the Gate Interface Board.
4. Label and disconnect all wires.

Connector	Wire Color(s)	Connects To:
J1	Red/White/Black	J1 on IGBT
J2	Red/White/Black	J2 on IGBT
J3	Red/White/Black	J3 on IGBT
J4	Orange/Black	J23 on Power Interface Board
J5	Blue/White	J18 on Power Interface Board
J6	Red/White	J4 on IGBT
J7	Red/White/Black	J7-W to J7-V (Gate Interface Boards W and V) J7-V to J7-U (Gate Interface Boards V and U) J7-U to J8 on Power Interface Board
J8	Black	J8-W to J8-V (Gate Interface Boards W and V) J8-V to J8-U (Gate Interface Boards V and U) J8-U to J6 on Power Interface Board

5. Remove the four 7 mm board-mounting nuts.
6. Remove the board; return or dispose of it properly.



Install Components

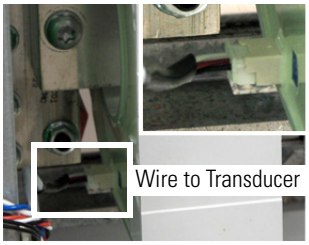
1. Install the new board.
2. Torque mounting nuts to 1.6 N•m (14 lb•in).
3. Reconnect wiring as detailed in the Table on previous page.
4. Replace all safety shields and enclosure covers before applying power to the drive.

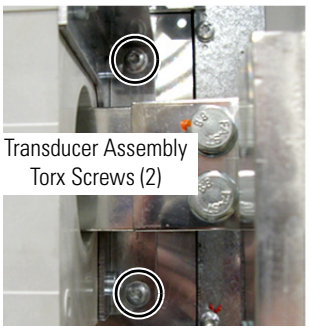
Current Transducer

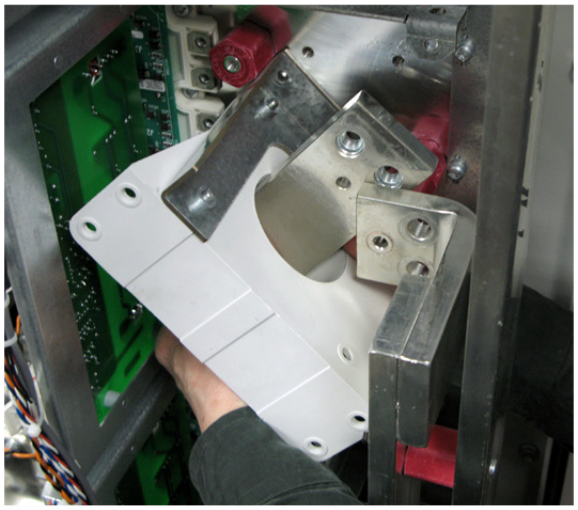
See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Locate the Current Transducer to be replaced.
3. Remove the Output Busbar at the Current Transducer. See page 64 for details.







4. Remove the two torx screws that secure the Current Transducer assembly (transducer and brackets) to the chassis.
5. Rotate the Current Transducer assembly counterclockwise and tip until the Output Busbar clears the U, V, or W Busbar and spacer.

   NOTE: Avoid any contact with the circuit board to the left of the transducer being removed.
6. Move the busbar and transducer to an ESD-safe flat surface for working with it.
7. Separate the Output Busbar from the Current Transducer.
8. Separate the Current Transducer from the brackets.
9. Properly discard the Current Transducer.

Install Components

1. Mount brackets to the new Current Transducer. Torque screw to 2.9 N•m (26 lb•in).
2. Slide Output Busbar through the Current Transducer assembly with the angled end to the left.
3. Replace the Current Transducer assembly in mounting position by reversing the process used in Step 5. of the removal process.
4. Secure the Current Transducer assembly to the drive chassis with two torx screws. Torque to 2.9 N•m (26 lb•in).
5. Reinstall the AC Output Busbar:
   a. Place the AC Output Busbar onto the two existing standoff set screws.
   b. Reinstall the six torx screws that secure the busbar to the IGBT heatsink. Torque to 5.6 N•m (50 lb•in).
   c. Reinstall the two standoff nuts. Torque to 5.7 N•m (50 lb•in).
6. Reinstall the Output Busbar:
   a. Reinstall the set screw. Hand tighten.
   b. Reinstall the torx bolt that secures the busbar to the AC Output Busbar. Torque to 9.0 N•m (80 lb•in).
   c. Reinstall the two hex head bolts that secure the busbar to the U, V, or W Busbar. Torque to 5.7 N•m (50 lb•in).
   d. Reinstall the standoff nut to the set screw. Torque the nut to 5.6 N•m (50 lb•in), which will torque the set screw correctly.
7. Reconnect the wire to the Current Transducer.
8. Replace all safety shields and enclosure covers before applying power to the drive.

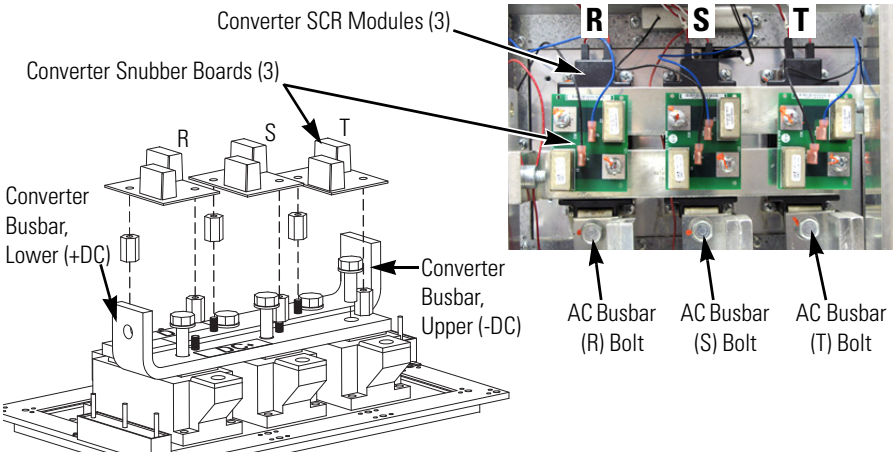
Converter Power Module (SCR) - AC Input Only

IMPORTANT If any Converter SCR module fails, all three SCR modules should be replaced (kit includes all three modules).

See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Remove the Main Control Panel. See page 24 for details.
3. Remove the Stacking Panel. See page 27.
4. Locate the Converter SCR modules (R, S, T) to be replaced.



5. Remove all three Converter Snubber Boards:
   a. Disconnect the wires between each Converter Snubber Resistor and Converter Snubber Board.
   b. Remove the two screws that secure each board.
   c. Remove each board and set aside.
6. Note the orientation of the Converter Busbars and remove the eight bolts that secure the busbars to the SCR modules and to the DC+ and DC- Busbars. Set the Converter Busbars aside.
7. Remove the bolt at the top of each AC Busbar (R, S, T) where they connect to the SCR modules.

   You do not need to remove the wires from the AC Busbars.
8. Label and note the position of the SCR module leads. Remove the leads.

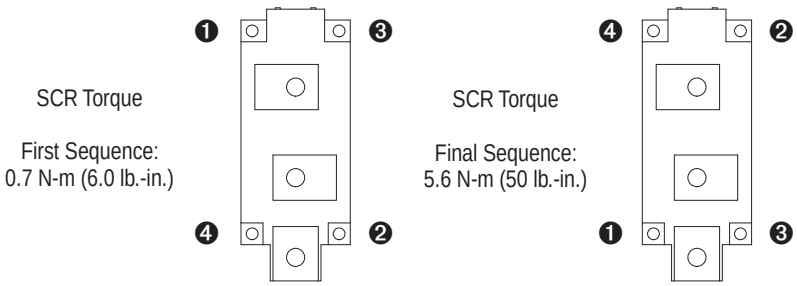
   Typically, the leads are marked as R, S, or T, and each is notched with the notch to the front of the SCR module.
9. Remove the four Phillips screws that hold each SCR to the Heatsink.
10. Remove the SCR modules; return or dispose of them properly.

Install Components

1. Using isopropyl alcohol, thoroughly clean the Heatsink mounting surface where each new SCR module will be installed.
2. Verify that the mounting surface of each new SCR module is clean. If not, clean with isopropyl alcohol.
3. Using a 3- or 4-inch paint roller or putty knife, apply a thin, even coating of the supplied thermal grease to the mounting surface of each new SCR module.

IMPORTANT In the next step, take care to not disturb any of the thermal grease on the SCR module.

4. Install each new SCR module with supplied screws and tighten using this torque sequence:



5. Replace the SCR module leads.

   Each set of leads is marked R, S, or T. The notch and red wire on each lead are positioned to the front.

6. Install the Converter Busbars per the illustration and step 6 on the previous page. Torque all bolts to 9.0 N•m (80 lb•in).
7. Install the Snubber Boards, oriented with the serial number at the top, and torque to 2.9 N•m (26 lb•in).
8. Replace the wires from the Converter Snubber Resistors to the Snubber Boards. See Converter Snubber Resistors - AC Input Only on page 73 to identify each resistor.

   The black wire goes to J1.
   The blue wire goes to J2.

9. Reinstall the bolts at the top of the AC Busbars (R, S, T). Torque to 9.0 N•m (80 lb•in).
10. Reinstall the DC+ and DC- Busbars and torque to 9.0 N•m (80 lb•in).
11. Reassemble remaining components in reverse order.
12. Replace all safety shields and enclosure covers before applying power to the drive.

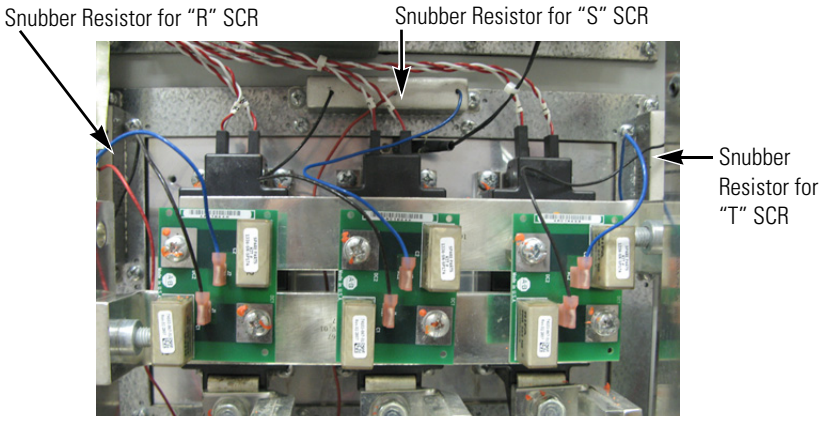
Converter Snubber Resistors - AC Input Only

See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

Kit includes Snubber Board and Resistor.

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Remove the Main Control Panel. See page 24 for details.
3. Remove the Stacking Panel. See page 27.
4. Locate the Snubber Resistor(s) to be replaced.



5. Verify the Snubber Resistor(s) with a volt ohm meter. The reading should be 8 ohms ± 10%.
   - If the reading is not within tolerance, perform the remainder of this procedure.
   - If the reading is within tolerance, do not perform the remainder of this procedure.
6. For the R Snubber Resistor only, remove the Transitional Busbar. See page 30 for details.
7. Label and disconnect the wires from Snubber Resistor(s) that will be replaced.
8. Remove the resistor(s) and properly discard.

Install Components

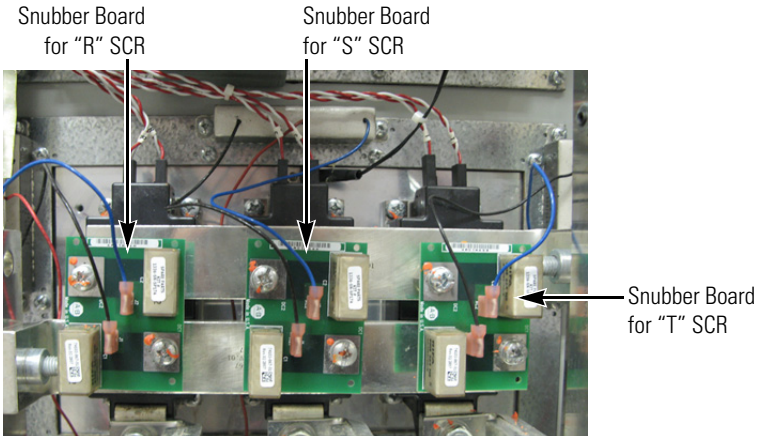
1. Using isopropyl alcohol, clean the surface where the new Snubber Resistor will be installed.
2. Verify that the mounting surface of the new Snubber Resistor is clean. If not, clean with isopropyl alcohol.
3. Using a 3-inch paint roller or putty knife, apply a thin even coating of the supplied thermal grease to the mounting surface of the new Snubber Resistor and install. Torque screws to 2.9 N•m (26 lb•in).
4. Reconnect wires.
5. Reassemble remaining components in reverse order.
6. Replace all safety shields and enclosure covers before applying power to the drive.

Converter Snubber Board - AC Input Only

See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Remove the Main Control Panel. See page 24 for details.
3. Remove the Stacking Panel. See page 27.
4. Locate the Converter Snubber Board to be replaced.



5. Label and disconnect wires from the Converter Snubber Resistor and the Converter Snubber Board to be replaced.
6. Remove the two screws that secure the board.
7. Remove the board and properly discard.

Install Components

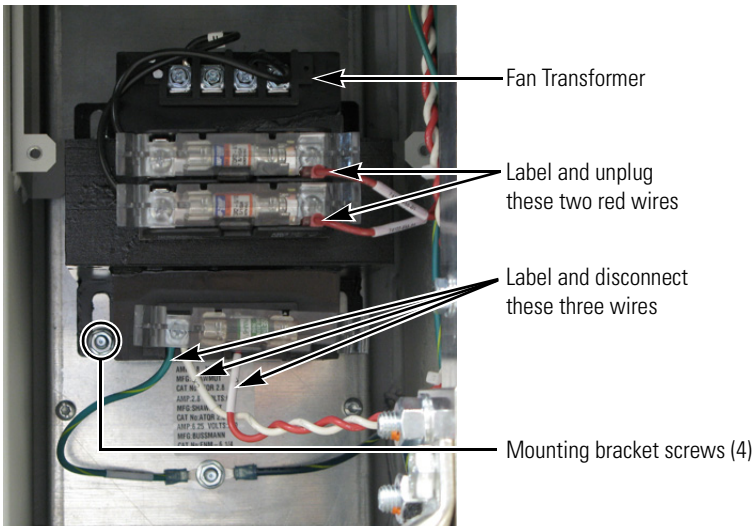
1. Install the new Snubber Board. Torque screws to 2.9 N•m (26 lb•in).
2. Reconnect wires from the Converter Snubber Resistor.
3. Black wire goes to J1. Blue wire goes to J2.
4. Reassemble remaining components in reverse order.
5. Replace all safety shields and enclosure covers before applying power to the drive.

Fan Transformer

See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.



2. Label and unplug or disconnect the five wires for the Fan Transformer.
3. Unscrew the four transformer mounting bracket screws.
4. Remove the transformer and properly discard.

Install Components

1. Install the new Fan Transformer by screwing mounting brackets to drive.
2. Reconnect all wires for the transformer.
3. Replace all safety shields and enclosure covers before applying power to the drive.

Heatsink Fan - Removal from Back of Drive

The Heatsink Fan is located on the back of the drive.

(For equipment clearance considerations, the Fan can also be removed from the front of the drive. See Heatsink Fan - Removal from the Front of Drive on page 79.)

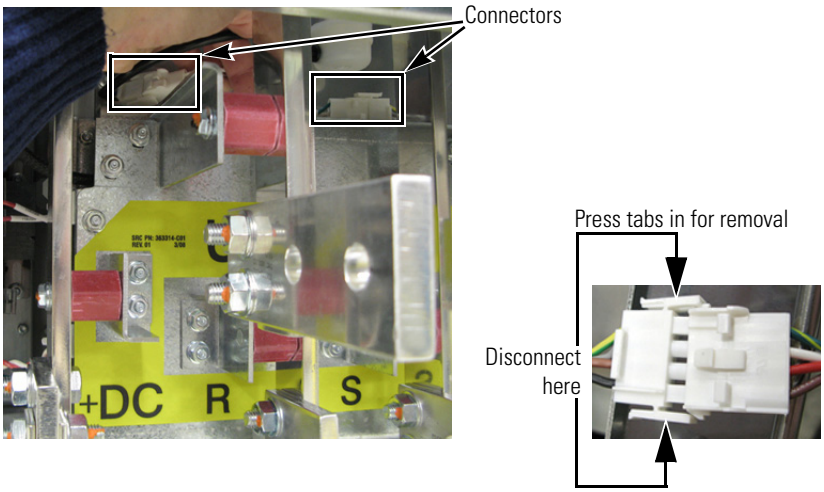
See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Verify that there is at least a 91 cm (3 ft) clearance in back of the drive for access to the Heatsink Fan.
3. From the front of the drive, disconnect the cables for the Fan and the Fan Capacitor.

   Access the cables by gently pulling the wiring from behind the busbar mounting panel.

   Front of drive



4. On the back of the drive, remove the 11 screws for the Fan cover; see the figure on the next page for the screw locations.

   Do not remove the screws for the screen.
5. Using the handle, separate the Fan assembly from the drive enclosure.

   Some force may be needed to separate the Fan from the enclosure as the gasket may be tight or sticky.
6. Remove Fan and properly discard.

Fan Cover Screw Locations on Back of Drive

Install Components

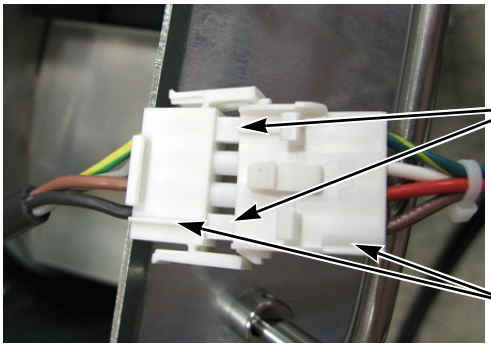
1. Place Fan assembly into the chassis but not installed in final position. Leave space for accessing Fan cables from the front of the drive.

   Take care to not pinch wires.

Fan Assembly
(Front View),
Removed from Drive

2. From the front of the drive, reconnect Fan cables.

TIP The connectors, one set shown below, are designed so they go together only one way. The two end sections are flat on one side and each section has a ridge at the matching edge.

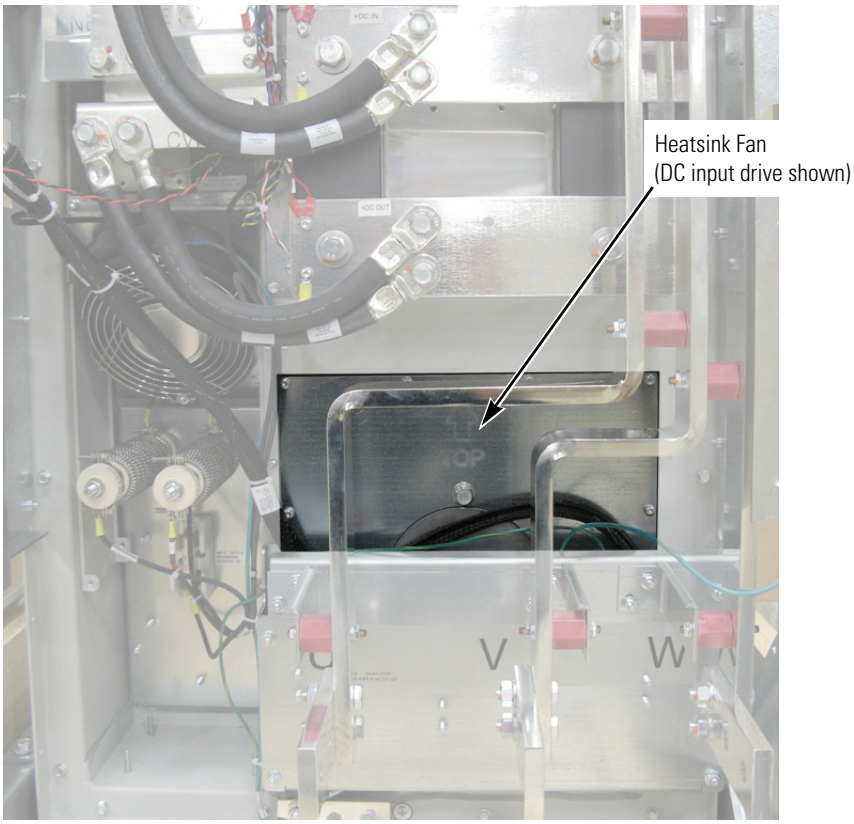


Connectors shown slightly separated

3. Place Fan assembly in final position in the chassis.
4. On the back of the drive, install the 11 screws for the Fan cover. Torque to 9.0 N•m (80 lb•in).

Heatsink Fan - Removal from the Front of Drive

The Heatsink Fan is located on the back of the drive. These instructions explain how to remove the fan from the front of the drive.



See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

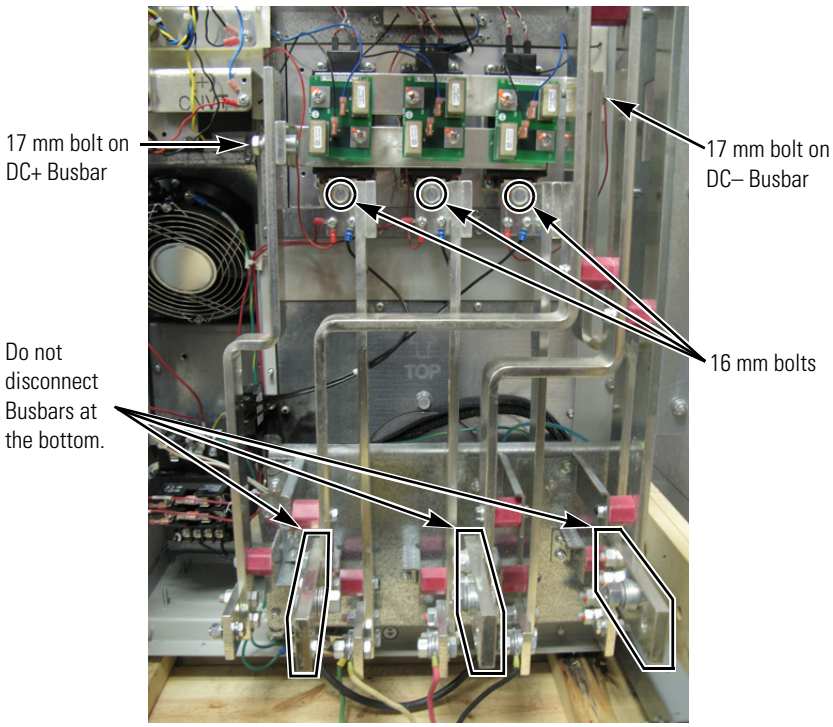
Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Disconnect all wiring to AC and DC Busbars so you can remove all busbars with the busbar mounting plate in a later step.
3. Remove the Main Control Panel. See page 24 for details.
4. Remove the Stacking Panel. See page 27.

5. AC input only: Disconnect the DC+ and DC- Busbars that connect to the Converter Busbars at the top of each bar.

   Do not disconnect the U, V, or W Busbars at the bottom.

AC Drive Shown



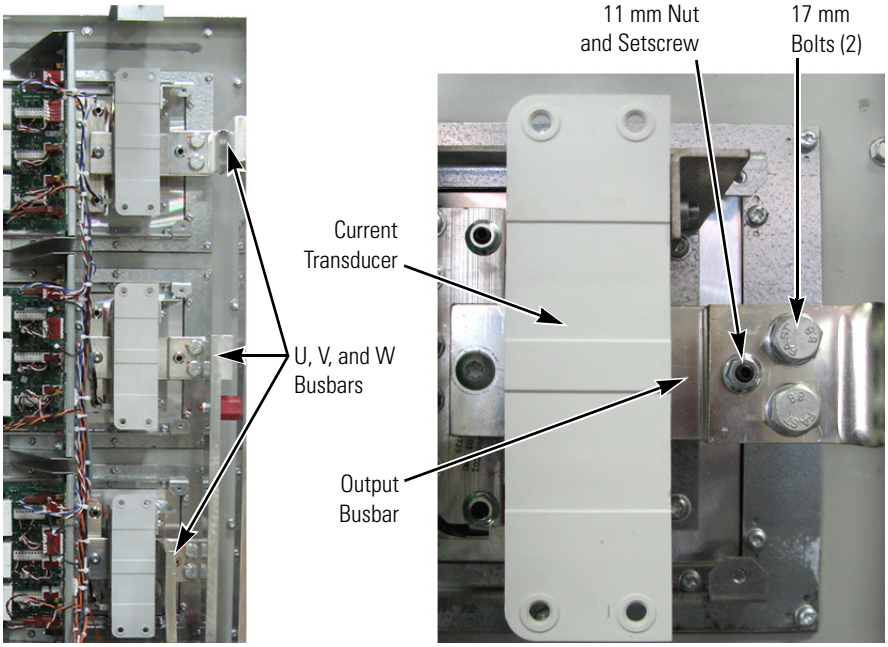
6. AC input only: Disconnect all busbars where they connect to the Converter SCR modules with 16 mm bolts. Disconnect wiring.

   Do not disconnect the U, V, or W Busbars at the bottom.

7. Disconnect the U, V, and W Busbars at the top of each bar where they connect to the Output Busbars for the Current Transducers with two 17 mm bolts and one 11 mm nut.

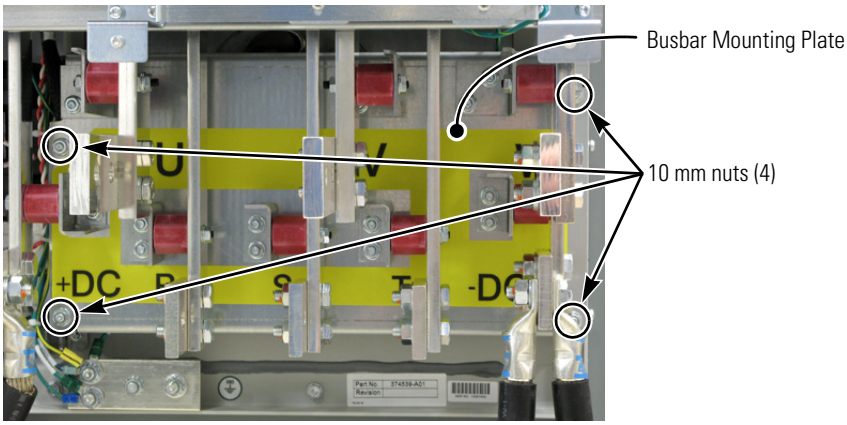
   Do not remove the busbars from the setscrew on the Output Busbars at this time.

   Do not disconnect the U, V, or W Busbars at the bottom.

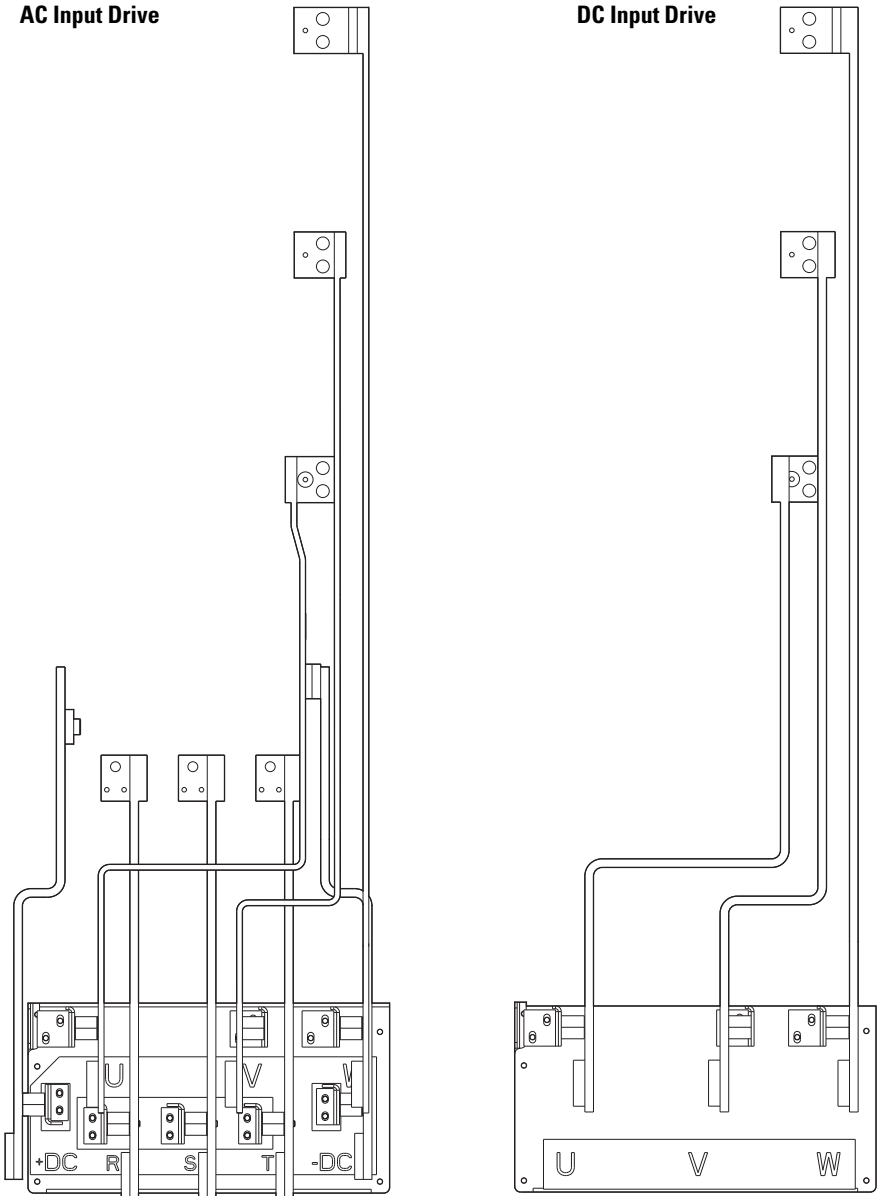


8. Remove the four 10 mm nuts for the busbars mounting plate.

AC Input Drive Shown



9. Remove the entire busbar and mounting plate assembly. Set aside.

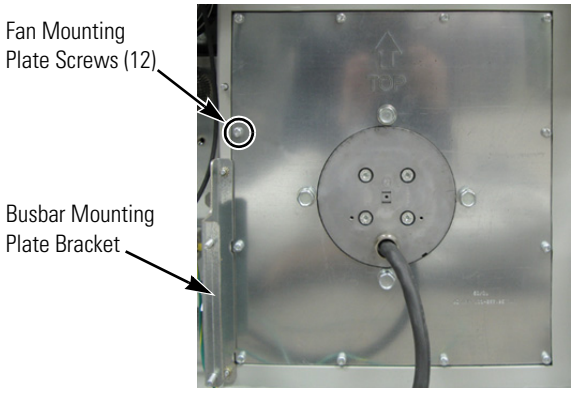


10. Unplug the fan cables.

11. For AC input only: Remove the MOV Surge Suppressor as instructed on page 88.

12. Remove the left busbar mounting plate bracket.

13. Remove the 12 exterior screws on the fan mounting plate.



14. Carefully remove the mounting plate and fan through the front of the drive chassis; you may need to pry the mounting plate away from the gasket.

    The fan housing remains mounted on the chassis.

Install Components

1. Remove the new fan housing from the new fan and mounting plate.

   Discard the new fan housing.
2. Install new fan and screw mounting plate to chassis.
3. Reassemble remaining components in reverse order of removal instructions.
4. Replace all safety shields and enclosure covers before applying power to the drive.

Thermal Sensors

In the AC input drive, the Thermal Sensor system consists of:

- A connector to J8 on each of the three Gate Interface Boards.
- A sensor secured to the Heatsink above the SCR modules.
- A sensor secured to the upper mounting bracket for the Main Control Panel.
- A connector to J6 on the Power Interface Board.
- Wiring to TB9 (terminals 9 and 10) on the Stacking Panel.
- Wiring to the DC Choke Plate at TB15 OUT and TB OUT, jumpered together internally.

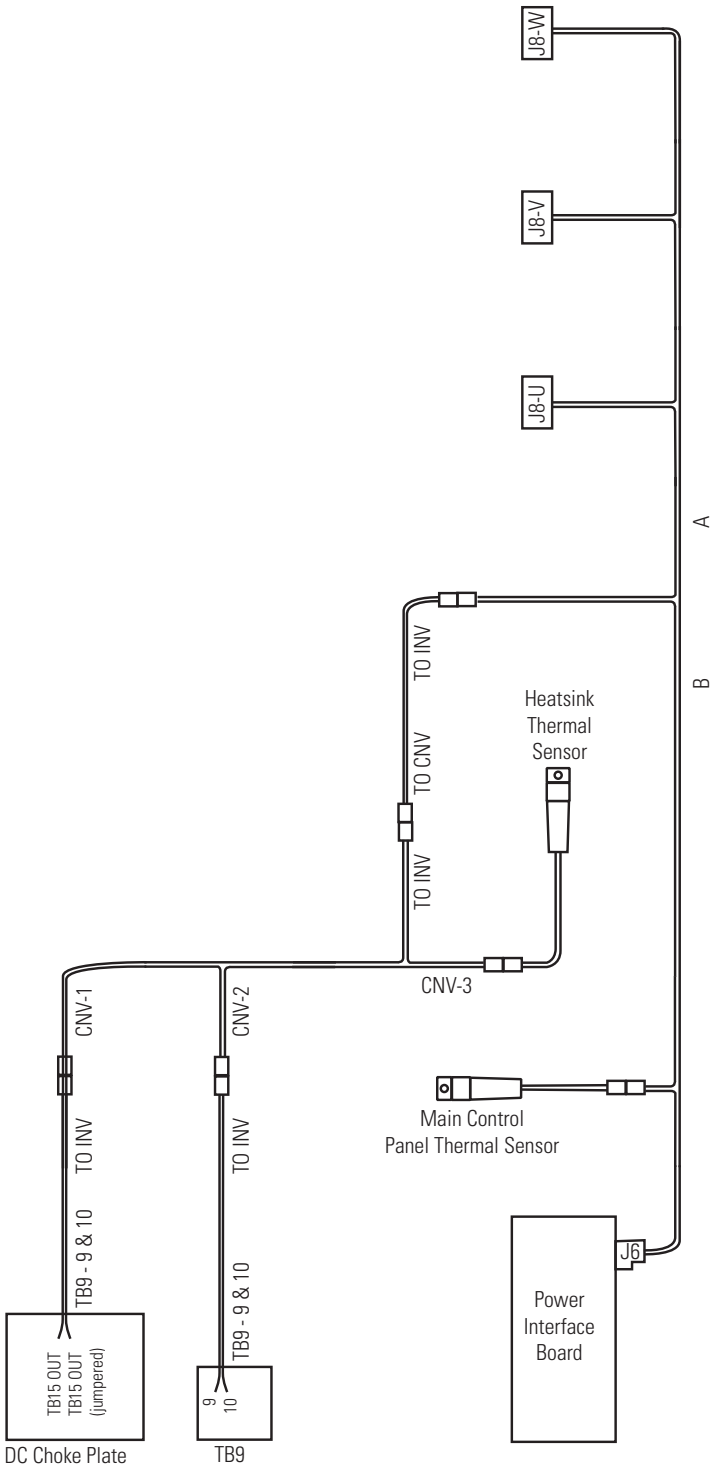
ATTENTION: Thermal sensors wired to the DC Choke Plate and to the three-phase motor cannot be replaced. The DC link choke and three-phase motor must be replaced if these thermal sensors or their wiring are destroyed.

In the DC input drive, the Thermal Sensor system consists of:

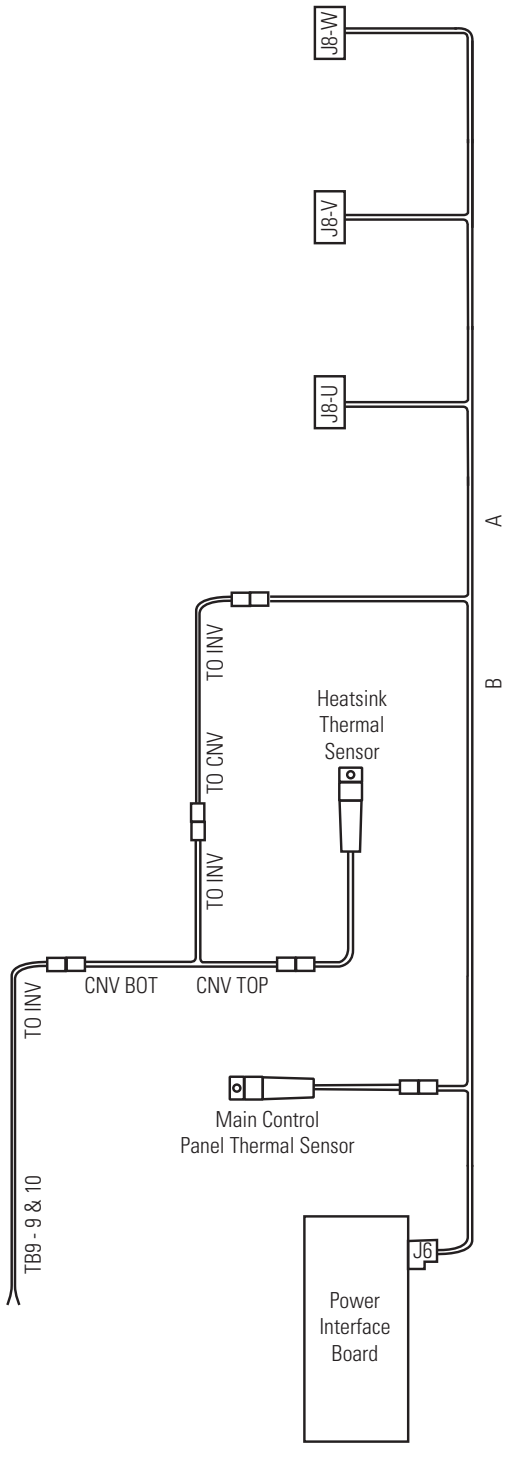
- A connector to J8 on each of the three Gate Interface Boards.
- A sensor secured to the Heatsink above the SCR modules.
- A sensor secured to the upper mounting bracket for the Main Control Panel.
- A connector to J6 on the Power Interface Board.
- Wiring to TB9 (terminals 9 and 10) on the Stacking Panel.

The connectors to J8 on each of the three Gate Interface Boards are wired in series. There is one J8 connector with four wires that senses the temperature of its IGBT. The other two connectors have two wires and only sense an over-temperature condition.

Thermal Sensor wiring for AC input drive



Thermal Sensor wiring for DC input drive

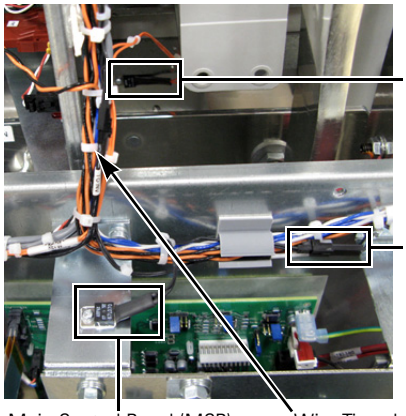


See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Cut the wire ties for the wiring harness along the Gate Interface Boards.
3. Note wire routing and location of sensors.
4. For the Main Control Panel thermal sensor, remove its screw and nut on the Main Control Panel and disconnect the other end from the wiring harness.

   Note: This screw and nut are small. Take care to not drop or misplace.



5. For the Heatsink thermal sensor, remove its screw on the Heatsink above the SCR modules and unplug the other end from the wiring harness.

   Note: This screw and nut are small. Take care to not drop or misplace.
6. Unplug the J8 connectors on each of the three Gate Interface Boards. See page 67 for connector locations.
7. Unplug the other end of this wiring harness at the J6 connector on the Power Interface Board. See page 39 for connector locations.

Install Components

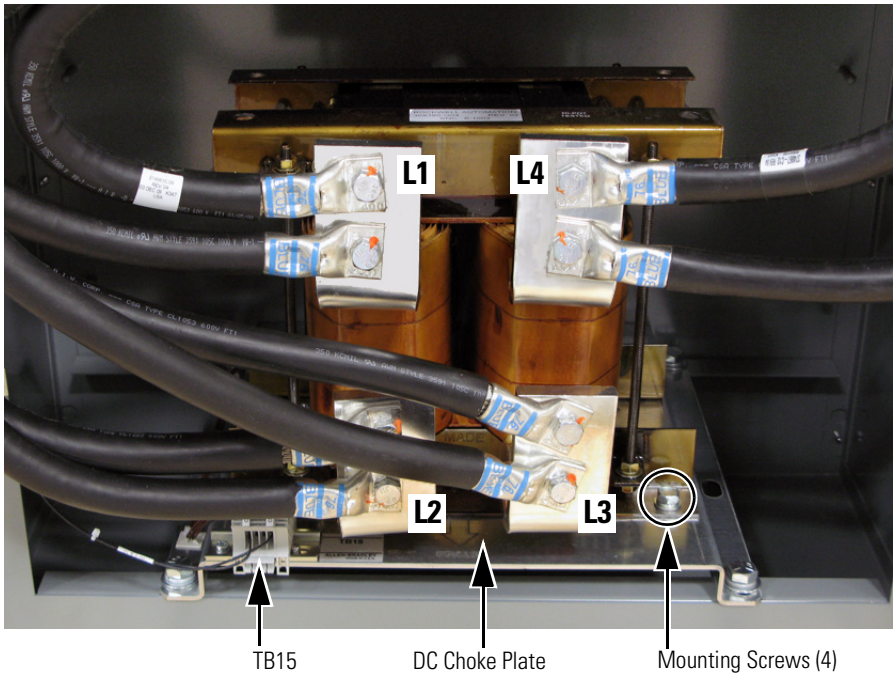
1. For the Main Control Panel thermal sensor or the Heatsink thermal sensor, apply a thin layer of supplied thermal grease to the metal side of the new Thermal Sensor and install it with supplied screw with star washer toward the panel. Torque screw to 1.7 N•m (15 lb•in).
2. For the three Gate Interface Boards, carefully route wires and connect to J8 on each Gate Interface Board. Be sure that the J8 connectors go to the correct IGBT. See page 67 for connector locations.
3. Reconnect the other end of this wiring harness at the J6 connector on the Power Interface Board. See page 39 for connector locations.
4. Reassemble remaining components in reverse order.
5. Replace all safety shields and enclosure covers before applying power to the drive.

DC Link Choke - AC Input Only

See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Locate the DC Link Choke.



3. Label and disconnect DC Choke connectors (L1...L4).
4. Label and disconnect wiring to TB15.
5. Remove the four screws that mount the DC Link Choke to the DC Choke Plate.
6. Remove the DC Link Choke and properly discard.

Install Components

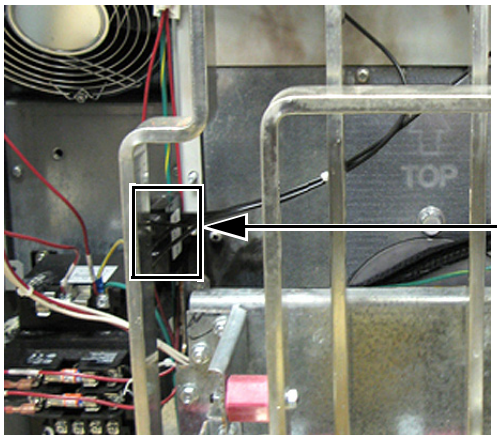
1. Install new DC Link Choke to DC Choke Plate.
2. Torque the four mounting screws to 9.0 N•m (80 lb•in).
3. Reassemble remaining components in reverse order.
4. Replace all safety shields and enclosure covers before applying power to the drive.

MOV Surge Suppressor - AC Input Only

See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Remove the Main Control Panel. See page 24 for details.
3. Remove the Stacking Panel. See page 27.
4. Locate the MOV Surge Suppressor assembly.



5. Note wire placement and connections. Disconnect the MOV ground wire to transformer and the R, S, and T wires to the AC Busbars.
6. Remove the MOV mounting nut.
7. Remove the MOV assembly and properly discard.

Install Components

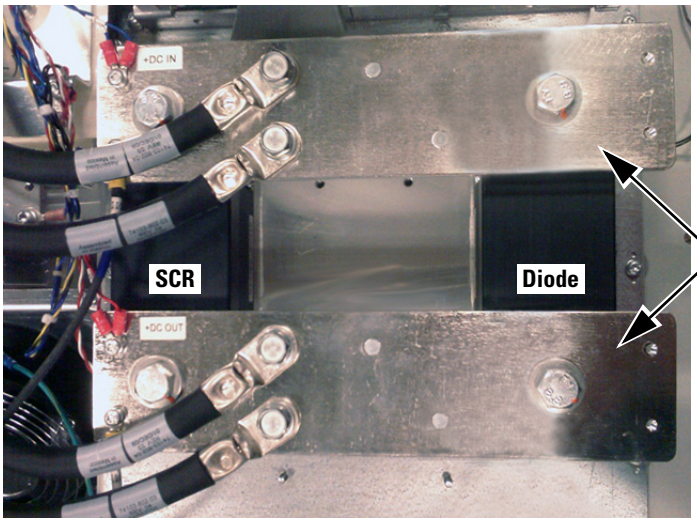
1. Install the new MOV assembly. Torque the MOV mounting nut to 2.9 N•m (26 lb•in).
2. Reconnect all wires and connectors for the MOV.
3. Torque the R, S, and T Phase power terminal block screws to 9.8 N•m (80 lb•in).
4. Reassemble remaining components in reverse order.
5. Replace all safety shields and enclosure covers before applying power to the drive.

Precharge SCR Module and Diode - DC Input Only

See Chapter 1 - Component Diagrams and Torque Specifications on page 13 to locate the component detailed in these instructions.

Remove Components

1. Read and follow the Safety Precautions on page 11 and Important Initial Steps on page 12.
2. Remove the Main Control Panel. See page 24 for details.
3. Remove the Stacking Panel. See page 27.
4. Locate the Precharge SCR module and Diode to be replaced.



5. Label and remove all DC+ power cables and all connected wires from the two busbars.
6. Remove the two busbars and carefully set aside.
7. For the Precharge SCR module, remove its connector wire.
8. Remove the SCR module and Diode, and properly discard them.

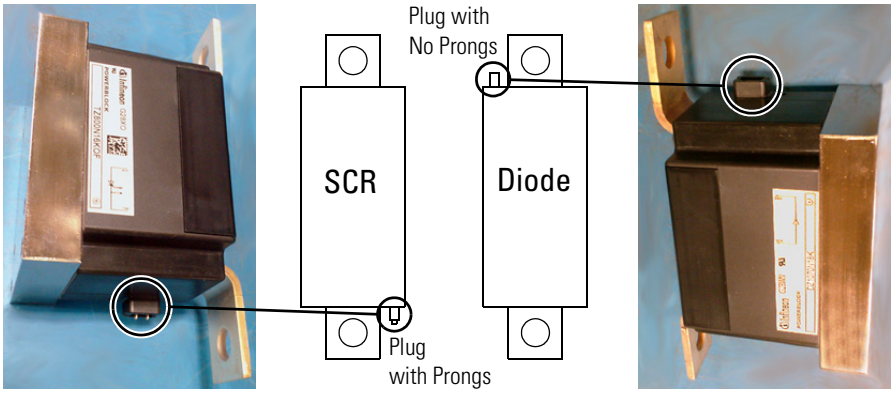
Install Components

1. Using isopropyl alcohol, thoroughly clean the Heatsink mounting surface where the SCR module and Diode will be installed.
2. Verify the mounting surfaces of the new SCR module and Diode are clean. If not, clean with isopropyl alcohol.

3. Using a 3- or 4-inch paint roller or putty knife, apply a thin, even coating of the supplied thermal grease to the mounting surface of each SCR module and Diode.

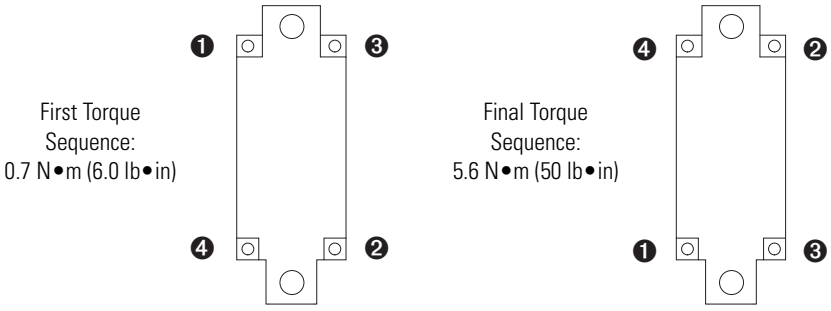
WARNING: In the next step, be sure to properly install the modules as shown. If you install the SCR incorrectly, it will not work. If you install the Diode incorrectly, then the Drive and the Bus Capacitors may not operate properly and may prematurely fail.

The SCR (on the left) has a plug **with** prongs located at the bottom. The Diode (on the right) has a plug **without** prongs located at the top.



IMPORTANT In the next step, take care to not disturb any of the thermal grease on the SCR module.

4. Install the SCR module or Diode with supplied screws and torque using the sequences and specifications shown in the diagram below.



5. Install the busbars, all wires, and the DC cables.
6. Torque DC cable screws to 12.2 N•m (108 lb•in).
7. Reassemble remaining components in reverse order.
8. Replace all safety shields and enclosure covers before applying power to the drive.

History of Changes

This appendix summarizes the revisions to this manual. Reference this appendix if you need information to determine what changes have been made across multiple revisions. This may be especially useful if you are deciding to upgrade your hardware or software based on information added with previous revisions of this manual.

20B-IN025B-EN-P, January 2011

Topic
Preface
Balancing resistor part number corrected in Component Kits table
Chapter 1
Overview heading and text added
Chapter 2
Overview heading added
Circuit board cross-reference text added to Overview section
Chapter 3
Overview heading and text added
Step 6 figure orientation changed in T-Comm removal section
J6 connector location changed from Main Control Board to Power Interface Board
Figure 7 removed from the Thermal Sensors section

Notes:

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